# SCIENTIFIC STUDY AND RESEARCH PROGRAM RELATING TO USES OF AGRICULTURAL PRODUCTS

UNIVERSITY OF MICHIGAN
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MAIN READING ROOM

## HEARING

BEFORE THE

## SUBCOMMITTEE ON RESEARCH AND EXTENSION

OF THE

## COMMITTEE ON AGRICULTURE
## HOUSE OF REPRESENTATIVES

EIGHTY-FOURTH CONGRESS

SECOND SESSION

ON

## H. R. 10121, 10123, 10125, 10145 and 10148

JULY 19, 1956

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# SCIENTIFIC STUDY AND RESEARCH PROGRAM RELATING TO USES OF AGRICULTURAL PRODUCTS

THURSDAY, JULY 19, 1956

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON RESEARCH AND EXTENSION
OF THE COMMITTEE ON AGRICULTURE,
*Washington, D. C.*

The subcommittee met at 10 a. m. in the committee room of the House Committee on Agriculture, Hon. Thomas G. Abernethy (chairman of the subcommittee) presiding.

Mr. ABERNETHY. The subcommittee is meeting this morning for the purposes of taking testimony on H. R. 10125, authored by our colleague, Hon. Ralph Harvey, and companion bill, authored by Representatives William S. Bray, Cecil M. Harden, E. Ross Adair, and John V. Beamer. The bills are H. R. 10121, H. R. 10123, H. R. 10125, H. R. 10145, and H. R. 10148.

(The bills are as follows:)

[H. R. 10121, 84th Cong., 2d sess.]

A BILL To provide for a scientific study and research program for the purpose of developing increased and additional industrial uses of agricultural products so as to reduce surpluses of such products and to increase the income of farmers, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

DECLARATIONS AND FINDINGS

SECTION 1. The Congress of the United States hereby makes the following declarations and findings concerning the development of new and additional industrial uses for agricultural products:

(a) Current productivity of farms in the United States is substantially in excess of current markets for their products at price levels which provide fair and substantial income to farmers.

(b) National defense and the security interests of the United States require increasing and expanding agricultural productivity to meet possible emergency needs of the United States and its allies, which productivity cannot be achieved or maintained at depressed farm prices resulting from overproduction or with acreage curtailments to avoid overproduction.

(c) It is in the national interest of the United States to increase the level of farm income in order that farmers may continue to share to a greater degree in the general prosperity of Nation.

(d) No program has been developed, and none can be foreseen, that can successfully shrink farm production for an extended period of time; but research programs provide known means potentially to increase substantially the industrial uses of agricultural products and thereby to achieve farm prosperity based on full, rather than curtailed production.

(e) Research facilities, both private and public, including those of land-grant colleges and universities, can and should be utilized for an all-out attack on the development of increased and additional industrial uses of agricultural products to enlarge opportunities for increased production by farmers and to reduce Government costs for the acquisition, storage, and ultimate disposition of agri-

cultural commodities which are now a substantial financial burden to the Government.

(f) The cost to the United States of such a research program may be expected to be more than offset by increased tax revenues resulting from increased earnings of both farmers and those who sell goods, wares, and merchandise to farmers, as well as by savings to the United States in costs of current agricultural asistance programs.

PURPOSES

SEC. 2. The purposes of this Act are to find and develop through research, sponsored and financed by the United States, new industrial uses, and increased use under existing processes, of agricultural products.

ADMINISTRATION CREATED

SEC. 3. There is hereby created in the executive branch of the Government an Industrial Agricultural Products Administration (hereinafter referred to as the Administration), in which is vested the duties, powers, and responsibilities hereafter set out in this Act. Such powers, duties, and responsibilities of the Administration shall be vested in an Administrator, who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall serve during the pleasure of the President. The Administrator shall receive compensation at the rate of $22,500 per annum.

DUTIES, POWERS, AND RESPONSIBILITIES OF THE ADMINISTRATION

SEC. 4. The Administration shall conduct research, both scientific and chemical, make field studies, conduct both laboratory and field experiments, test production procedures on a commercial basis, maintain and expand pilot plants whenever necessary, maintain and operate manufacturing facilities where necessary to prove the commercial feasibility of volume production, and otherwise promote the finding, development, and commercial use of new, increased, extended, and perfected processes, techniques, and programs for industrial uses of greater quantities of agricultural products.

POWERS OF THE ADMINISTRATION AND THE ADMINISTRATOR

SEC. 5. The Administration is authorized to:

(a) Utilize such existing facilities of the United States, and such trained personnel employed by the United States, as the President finds can feasibly be transferred to the Administration for carrying out the purposes of this Act. The President is hereby authorized to (1) transfer any such facility, facilities, or personnel to the Administration, or to (2) make any such facility, facilities, or personnel available to the Administration for carrying out the purposes of this Act.

(b) Build, purchase, or lease plant facilities, or necessary equipment, suitable for research, pilot plant, manufacturing, or other needs of the Administration in carrying out the purposes of this Act.

(c) Employ such personnel as may be necessary to carry out the purposes of this Act; and all technical or scientific employees engaged for research by the Administration shall be exempt from the civil service laws and regulations.

(d) Employ or retain on a contract basis individuals, firms, institutions, and organizations, public and private, including land-grant colleges and universities, to conduct research programs for the Administration pursuant to this Act.

SEC. 6. The Administration is authorized to pay incentive awards to private citizens for suitable and acceptable suggestions to implement the program established by this Act, such payments to be made in accordance with previously published rules stating the amounts of, criteria for determining, and subjects of, such awards.

SEC. 7. The Administrator is authorized to appoint Industry Advisory Committees and to employ consultants without compensation or at rates of compensation not to exceed $50 per diem.

SEC. 8. The Administration may make grants to accredited schools, colleges, and universities for fellowships and scholarships in research for the purposes of this Act.

INDUSTRIAL AGRICULTURAL PRODUCTS AGENCY CREATED

SEC. 9. There is hereby created in the Department of Agriculture an Industrial Agricultural Products Agency (hereinafter referred to as the "Agency"). The duties, obligations, and responsibilities of the Agency shall be carried out by and under the direction of the Secretary of Agriculture.

DUTIES AND RESPONSIBILITIES OF THE AGENCY

SEC. 10. Under the delegations, directives, and policy determinations of the Administrator, the Agency shall carry out all of the duties, obligations, and responsibilities imposed upon the Administration by this Act, including the making of research contracts, employment of personnel, contracts for the construction, purchase, lease, or other acquisition of real or personal property, and the maintenance of all records, files, studies, and other data undertaken pursuant to this Act. Notwithstanding any other provisions of this Act, the Administrator may delegate any power given him hereunder to the Agency, and he may control, supervise, and direct all Agency action permitted by law under this Act.

SEC. 11. The Administrator shall report semi-annually to the Congress progress on research programs undertaken pursuant to this Act to find and develop new and increased industrial uses for agricultural products.

SEC. 12. The Agency may license, at a fair and reasonable royalty, any person, firm, or corporation to use any process developed by the Agency or to make and sell under any patent, or application for patent of the Agency. Such royalties shall be based upon fair compensation to the Government for its investment and shall be nondiscriminatory. Whenever the Administrator finds it in the public interest to do so, he may grant royalty-free licenses for processes developed under this Act, including the right to make and sell under any patent or application for patent of the Agency.

APPROPRIATIONS

SEC. 13. There is hereby authorized to be appropriated to the Department of Agriculture, for the Industrial Agricultural Products Agency, the sum of $100,000,000 for the fiscal year beginning July 1, 1956, and the same amount annually thereafter. There shall be paid out of such appropriations the salary of the Administrator as well as all other expenses of his office. The President is authorized to transfer to the Agency $1,000,000 out of unexpended Agricultural Department funds to initiate promptly this program following the enactment of this Act for and during the fiscal year ending June 30, 1956.

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[H. R. 10123, 84th Cong. 2d sess.]

A BILL To provide for a scientific study and research program for the purpose of developing increased and additional industrial uses of agricultural products so as to reduce surpluses of such products and to increase the income of farmers, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

DECLARATION AND FINDINGS

SECTION 1. The Congress of the United States hereby makes the following declarations and findings concerning the development of new and additional industrial uses for agricultural products:

(a) Current productivity of farms in the United States is substantially in excess of current markets for their products at price levels which provide fair and substantial income to farmers.

(b) National defense and the security interests of the United States require increasing and expanding agricultural productivity to meet possible emergency needs of the United States and its allies, which productivity cannot be achieved or maintained at depressed farm prices resulting from overproduction or with acreage curtailments to avoid overproduction.

(c) It is in the national interest of the United States to increase the level of farm income in order that farmers may continue to share to a greater degree in the general prosperity of the Nation.

(d) No program has been developed, and none can be foreseen, that can successfully shrink farm production for an extended period of time; but research programs provide known means potentially to increase substantially the in-

dustrial uses of agricultural products and thereby to achieve farm prosperity based on full, rather than curtailed, production.

(e) Research facilities, both private and public, including those of land-grant colleges and universities, can and should be utilized for an all-out attack on the development of increased and additional industrial uses of agricultural products enlarge opportunities for increased production by farmers and to reduce Government costs for the acquisition, storage, and ultimate disposition of agricultural commodities which are now a substantial financial burden to the Government.

(f) The cost of the United States of such a research program may be expected to be more than offset by increased tax revenues resulting from increased earnings of both farmers and those who sell goods, wares, and merchandise to farmers, as well as by savings to the United States in costs of current agricultural assistance programs.

PURPOSES

SEC. 2. The purposes of this Act are to find and develop through research, sponsored and financed by the United States, new industrial uses, and increased use under existing processes, of agricultural products.

ADMINISTRATION CREATED

SEC. 3. There is hereby created in the executive branch of the Government an Industrial Agricultural Products Administration (hereinafter referred to as the Administration), in which is vested the duties, powers, and responsibilities hereafter set out in this Act. Such powers, duties, and responsibilities of the Administration shall be vested in an Administrator, who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall serve during the pleasure of the President. The Administrator shall receive compensation at the rate of $22,500 per annum.

DUTIES, POWERS, AND RESPONSIBILITIES OF THE ADMINISTRATION

SEC. 4. The Administration shall conduct research, both scientific and chemical, make field studies, conduct both laboratory and field experiments, test production procedures on a commercial basis, maintain and expand pilot plants whenever necessary, maintain and operate manufacturing facilities where necessary to prove the commercial feasibility of volume production, and otherwise promote the finding, development, and commercial use of new, increased, extended, and perfected processes, techniques, and programs for industrial uses of greater quantities of agricultural products.

POWERS OF THE ADMINISTRATION AND THE ADMINISTRATOR

SEC. 5. The Administration is authorized to:

(a) Utilize such existing facilities of the United States, and such trained personnel employed by the United States, as the President finds can feasibly be transferred to the Administration for carrying out the purposes of this Act. The President is hereby authorized to (1) transfer any such facility, facilities, or personnel to the Administration, or to (2) make any such facility, facilities, or personnel available to the Administration for carrying out the purposes of this Act.

(b) Build, purchase, or lease plant facilities, or necessary equipment, suitable for research, pilot plant, manufacturing or other needs of the Administration in carrying out the purposes of this Act.

(c) Employ such personnel as may be necessary to carry out the purposes of this Act; and all technical or scientific employees engaged for research by the Administration shall be exempt from the civil service laws and regulations.

(d) Employ or retain on a contract basis individuals, firms, institutions, and organizations, public and private, including land-grant colleges and universities, to conduct research programs for the Administration pursuant to this Act.

SEC. 6. The Administration is authorized to pay incentive awards to private citizens for suitable and acceptable suggestions to implement the program established by this Act, such payments to be made in accordance with previously published rules stating the amounts of, criteria for determining, and subjects of, such awards.

SEC. 7. The Administrator is authorized to appoint Industry Advisory Committees and to employ consultants without compensation or at rates of compensation not to exceed $50 per diem.

SEC. 8. The Administration may make grants to accredited schools, colleges, and universities for fellowships and scholarships in research for the purpose of this Act.

INDUSTRIAL AGRICULTURAL PRODUCTS AGENCY CREATED

SEC. 9. There is hereby created in the Department of Agriculture an Industrial Agricultural Products Agency (hereinafter referred to as the "Agency"). The duties, obligations, and responsibilities of the Agency shall be carried out by and under the direction of the Secretary of Agriculture.

DUTIES AND RESPONSIBILITIES OF THE AGENCY

SEC. 10. Under the delegations, directives, and policy determinations of the Administrator, the Agency shall carry out all of the duties, obligations, and responsibilities imposed upon the Administration by this Act, including the making of research contracts, employment of personnel, contracts for the construction, purchase, lease, or other acquisition of real or personal property, and the maintenance of all records, files, studies and other data undertaken pursuant to this Act. Notwithstanding any other provisions of this Act, the Administrator may delegate any power given him hereunder to the Agency, and he may control, supervise, and direct all Agency action permitted by law under this Act.

SEC. 11. The Administrator shall report semiannualy to the Congress progress on research programs undertaken pursuant to this Act to find and develop new and increased industrial uses for agricultural products.

SEC. 12. The Agency may license, at a fair and reasonable royalty, any person, firm, or corporation to use any process developed by the Agency or to make and sell under any patent, or application for patent of the Agency. Such royalties shall be based upon fair compensation to the Government for its investment and shall be nondiscriminatory. Whenever the Administrator finds it in the public interest to do so, he may grant royalty-free licenses for processes developed under this Act, including the right to make and sell under any patent or application for patent of the Agency.

APPROPRIATIONS

SEC. 13. There is hereby authorized to be appropriated to the Department of Agriculture, for the Industrial Agricultural Products Agency, the sum of $100,000,000 for the fiscal year beginning July 1, 1956, and the same amount annually thereafter. There shall be paid out of such appropriations the salary of the Administrator as well as all other expenses of his office. The President is authorized to transfer to the Agency $1,000,000 out of unexpended Agricultural Department funds to initiate promptly this program following the enactment of this Act for and during the fiscal year ending June 30, 1956.

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[H. R. 10125, 84th Cong., 2d sess.]

A BILL To provide for a scientific study and research program for the purpose of developing increased and additional industrial uses of agricultural products so as to reduce surpluses of such products and to increase the income of farmers, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

DECLARATIONS AND FINDINGS

SECTION 1. The Congress of the United States hereby makes the following declarations and findings concerning the development of new and additional industrial uses for agricultural products:

(a) Current productivity of farms in the United States is substantially in excess of current markets for their products at price levels which provide fair and substantial income to the farmers.

(b) National defense and the security interests of the United States require increasing and expanding agricultural productivity to meet possible emergency needs of the United States and its allies, which productivity cannot be achieved or maintained at depressed farm prices resulting from overproduction or with acreage curtailments to avoid overproduction.

(c) It is in the national interest of the United States to increase the level of farm income in order that farmers may continue to share to a greater degree in the general prosperity of the Nation.

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(d) No program has been developed, and none can be foreseen, that can successfully shrink farm production for an extended period of time; but research programs provide known means potentially to increase substantially the industrial uses of agricultural products and thereby to achieve farm prosperity based on full, rather than curtailed, production.

(e) Research facilities, both private and public, including those of land-grant colleges and universities, can and should be utilized for an all-out attack on the development of increased and additional industrial uses of agricultural products to enlarge opportunities for increased production by farmers and to reduce Government costs for the acquisition, storage and ultimate disposition of agricultural commodities which are now a substantial financial burden to the Government.

(f) The cost to the United States of such a research program may be expected to be more than offset by increased tax revenues resulting from increased earnings of both farmers and those who sell goods, wares, and merchandise to farmers, as well as by savings to the United States in costs of current agricultural assistance programs.

PURPOSE

SEC. 2. The purposes of this Act are to find and develop through research, sponsored and financed by the United States, new industrial uses, and increased use under existing processes, of agricultural products.

ADMINISTRATION CREATED

SEC. 3. There is hereby created in the executive branch of the Government an Industrial Agricultural Products Administration (hereinafter referred to as the "Administration"), in which is vested the duties, powers, and responsibilities hereafter set out in this Act. Such powers, duties, and responsibilities of the Administration shall be vested in an Administrator, who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall serve during the pleasure of the President. The Administrator shall receive compensation at the rate of $22,500 per annum.

DUTIES, POWERS, AND RESPONSIBILITIES OF THE ADMINISTRATION

SEC. 4. The Administration shall conduct research, both scientific and chemical, make field studies, conduct both laboratory and field experiments, test production procedures on a commercial basis, maintain and expand pilot plants whenever necessary, maintain and operate manufacturing facilities where necessary to prove the commercial feasibility of volume production, and otherwise promote the finding, development, and commercial use of new, increased, extended, and perfected processes, techniques, and programs for industrial uses of greater quantities of agricultural products.

POWERS OF THE ADMINISTRATION AND THE ADMINISTRATOR

SEC. 5. The Administration is authorized to:

(a) Utilize such existing facilities of the United States, and such trained personnel employed by the United States, as the President finds can feasibly be transferred to the Administration for carrying out the purposes of this Act. The President is hereby authorized to (1) transfer any such facility, facilities, or personnel to the Administration, or to (2) make any such facility, facilities, or personnel available to the Administration for carrying out the purposes of this Act.

(b) Build, purchase, or lease plant facilities, or necessary equipment, suitable for research, pilot plant, manufacturing, or other needs of the Administration in carrying out the purposes of this Act.

(c) Employ such personnel as may be necessary to carry out the purposes of this Act; and all technical or scientific employees engaged for research by the Administration shall be exempt from the civil-service laws and regulations.

(d) Employ or retain on a contract basis individuals, firms, institutions, and organizations, public and private, including land-grant colleges and universities, to conduct research programs for the Administration pursuant to this Act.

SEC. 6. The Administration is authorized to pay incentive awards to private citizens for suitable and acceptable suggestions to implement the program established by this Act, such payments to be made in accordance with previously

published rules stating the amounts of, criteria for determining, and subjects of, such awards.

SEC. 7. The Administrator is authorized to appoint Industry Advisory Committees and to employ consultants without compensation or at rates of compensation not to exceed $50 per diem.

SEC. 8. The Administration may make grants to accredited schools, colleges, and universities for fellowships and scholarships in research for the purposes of this Act.

INDUSTRIAL AGRICULTRUAL PRODUCTS AGENCY CREATED

SEC. 9. There is hereby created in the Department of Agriculture an Industrial Agricultural Products Agency (hereinafter referred to as the "Agency"). The duties, obligations, and responsibilities of the Agency shall be carried out by and under the direction of the Secretary of Agriculture.

DUTIES AND RESPONSIBILITIES OF THE AGENCY

SEC. 10. Under the delegations, directives, and policy determinations of the Administrator, the Agency shall carry out all of the duties, obligations, and responsibilities imposed upon the Administration by this Act, including the making of research contracts, employment of personnel, contracts for the construction, purchase, lease, or other acquisition of real or personal property, and the maintenance of all records, files, studies, and other data undertaken pursuant to this Act. Notwithstanding any other provisions of this Act, the Administrator may delegate any power given him hereunder to the Agency, and he may control, supervise, and direct all Agency action permitted by law under this Act.

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APPROPRIATIONS

SEC. 13. There is hereby authorized to be appropriated to the Department of Agriculture, for the Industrial Agricultural Products Agency, the sum of $100,000,000 for the fiscal year beginning July 1, 1956, and the same amount annually thereafter. There shall be paid out of such appropriations the salary of the Administrator as well as all other expenses of his office. The President is authorized to transfer to the Agency $1,000,000 out of unexpended Agricultural Department funds to initiate promptly this program following the enactment of this Act for and during the fiscal year ending June 30, 1956.

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[H. R. 10145, 84th Cong., 2d sess.]

A BILL To provide for a scientific study and research program for the purpose of developing increased and additional industrial uses of agricultural products so as to reduce surpluses of such products and to increase the income of farmers, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

DECLARATIONS AND FINDINGS

SECTION 1. The Congress of the United States hereby makes the following declarations and findings concerning the development of new and additional industrial uses for agricultural products:

(a) Current productivity of farms in the United States is substantially in excess of current markets for their products at price levels which provide fair and substantial income to farmers.

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(c) It is in the national interest of the United States to increase the level of farm income in order that farmers may continue to share to a greater degree in the general prosperity of the Nation.

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(e) Research facilities, both private and public, including those of land-grant colleges and universities, can and should be utilized for an all-out attack on the development of increased and additional industrial uses of agricultural products to enlarge opportunities for increased production by farmers and to reduce Government costs for the acquisition, storage, and ultimate disposition of agricultural commodities which are now a substantial financial burden to the Government.

(f) The cost to the United States of such a research program may be expected to be more than offset by increased tax revenues resulting from increased earnings of both farmers and those who sell goods, wares, and merchandise to farmers, as well as by savings to the United States in costs of current agricultural assistance programs.

PURPOSES

SEC. 2. The purposes of this Act are to find and develop through research, sponsored and financed by the United States, new industrial uses, and increased use under existing processes of agricultural products.

ADMINISTRATION CREATED

SEC. 3. There is hereby created in the executive branch of the Government an Industrial Agricultural Products Administration (hereinafter referred to as the Administration), in which is vested the duties, powers and responsibilities hereinafter set out in this Act. Such powers, duties, and responsibilities of the Administration shall be vested in an Administrator, who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall serve during the pleasure of the President. The Administrator shall receive compensation at the rate of $22,500 per annum.

DUTIES, POWERS, AND RESPONSIBILITIES OF THE ADMINISTRATION

SEC. 4. The Administration shall conduct research, both scientific and chemical, make field studies, conduct both laboratory and field experiments, test production procedures on a commercial basis, maintain and expand pilot plants whenever necessary, maintain and operate manufacturing facilities where necessary to prove the commercial feasibility of volume production, and otherwise promote the finding, development, and commercial use of new, increased, extended, and perfected processes, techniques, and programs for industrial uses of greater quantities of agricultural products.

POWERS OF THE ADMINISTRATION AND THE ADMINISTRATOR

SEC. 5. The Administration is authorized to:

(a) Utilize such existing facilities of the United States, and such trained personnel employed by the United States, as the President finds can feasibly be transferred to the Administration for carrying out the purposes of this Act. The President is hereby authorized to (1) transfer any such facility, facilities, or personnel to the Administration, or to (2) make any such facility, facilities, or personnel available to the Administration for carrying out the purposes of this Act.

(b) Build, purchase, or lease plant facilities, or necessary equipment, suitable for research, pilot plant management, manufacturing or other needs of the Administration in carrying out the purposes of this Act.

(c) Employ such personel as may be necessary to carry out the purposes of this Act; and all technical or scientific employees engaged for research by the Administration shall be exempt from the civil service laws and regulations.

(d) Employ or retain on a contract basis individuals, firms, institutions, and organizations, public and private, including land-grant colleges and universities, to conduct research programs for the Administration pursuant to this Act.

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SEC. 7. The Administrator is authorized to appoint industry advisory committees and to employ consultants without compensation or at rates of compensation not to exceed $50 per diem.

SEC. 8. The Administration may make grants to accredited schools, colleges, and universities for fellowships and scholarships in research for the purposes of this Act.

INDUSTRIAL, AGRICULTURAL PRODUCTS AGENCY CREATED

SEC. 9. There is hereby created in the Department of Agriculture an Industrial Agricultural Products Agency (hereinafter referred to as the "Agency"). The duties, obligations, and responsibilities of the Agency shall be carried out by and under the direction of the Secretary of Agriculture.

DUTIES AND RESPONSIBILITIES OF THE AGENCY

SEC. 10. Under the delegations, directives, and policy determinations of the Administrator, the Agency shall carry out all of the duties, obligations, and responsibilities imposed upon the Administration by this Act, including the making of research contracts, employment of personnel, contracts for the construction, purchase, lease, or other acquisition of real or personal property, and the maintenance of all records, files, studies and other data undertaken pursuant to this Act. Notwithstanding any other provisions of this Act, the Administrator may delegate any power given him hereunder to the Agency, and he may control, supervise, and direct all Agency action permitted by law under this Act.

SEC. 11. The Administrator shall report semiannually to the Congress progress on research programs undertaken pursuant to this Act to find and develop new and increased industrial uses for agricultural products.

SEC. 12. The Agency may license, at a fair and reasonable royalty, any person, firm, or corporation to use any process developed by the Agency or to make and sell under any patent, or application for patent of the Agency. Such royalties shall be based upon fair compensation to the Government for its investment and shall be nondiscriminatory. Whenever the Administrator finds it in the public interest to do so, he may grant royalty-free licenses for processes devolped under this Act, including the right to make and sell under any patent or application for patent of the Agency.

APPROPRIATIONS

SEC. 13. There is hereby authorized to be appropriated to the Department of Agriculture, for the Industrial Agricultural Products Agency, the sum of $100,000,000 for the fiscal year beginning July 1, 1956, and the same amount annually thereafter. There shall be paid out of such appropriations the salary of the Administrator as well as all other expenses of his office. The President is authorized to transfer to the Agency $1,000,000 out of unexpended Agricultural Department funds initiate promptly this program following the enactment of this Act for and during the fiscal year ending June 30, 1956.

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[H. R. 10148, 84th Cong., 2d sess.]

A BILL To provide for a scientific study and research program for the purpose of developing increased and additional industrial uses of agricultural products so as to reduce surpluses of such products and to increase the income of farmers, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,*

DECLARATIONS AND FINDINGS

SECTION 1. The Congress of the United States hereby make the following declarations and findings concerning the development of new and additional industrial uses for agricultural products:

(a) Current productivity of farms in the United States is substantially in excess of current markets for their products at price levels which provide fair and substantial income to farmers.

(b) National defense and the security interests of the United States require increasing and expanding agricultural productivity to meet possible emergency needs of the United States and its allies, which productivity cannot be achieved or maintained at depressed farm prices resulting from overproduction or with acreage curtailments to avoid overproduction.

(c) It is in the national interest of the United States to increase the level of farm income in order that farmers may continue to share to a greater degree in the general prosperity of the Nation.

(d) No program has been developed, and none can be foreseen, that can successfully shrink farm production for an extended period of time; but research programs provide known means potentially to increase substantially the industrial uses of agricultural products and thereby to achieve farm prosperity based on full, rather than curtailed, production.

(e) Research facilities, both private and public, including those of land-grant colleges and universities, can and should be utilized for an all-out attack on the developments of increased and additional industrial uses of agricultural products to enlarge opportunities for increased production by farmers and to reduce Government costs for the acquisition, storage, and ultimate disposition of agricultural commodities which are now a substantial financial burden to the Government.

(f) The cost to the United States of such a research program may be expected to be more than offset by increased tax revenues resulting from increased earnings of both farmers and those who sell goods, wares, and merchandise to farmers, as well as by savings to the United States in costs of current agricultural assistance programs.

PURPOSES

SEC. 2. The purposes of this Act are to find and develop through research, sponsored and financed by the United States, new industrial uses, and increased use under existing processes, of agricultural products.

ADMINISTRATION CREATED

SEC. 3. There is hereby created in the executive branch of the Government an Industrial Agricultural Products Administration (hereinafter referred to as the Administration), in which is vested the duties, powers and responsibilities hereafter set out in this Act. Such powers, duties, and responsibilities of the Administration shall be vested in an Administrator, who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall serve during the pleasure of the President. The Administrator shall receive compensation at the rate of $22,500 per annum.

DUTIES, POWERS, AND RESPONSIBILITIES OF THE ADMINISTRATION

SEC. 4. The Administration shall conduct research, both scientific and chemical, make field studies, conduct both laboratory and field experiments, test production procedures on a commercial basis, maintain and expand pilot plants whenever necessary, maintain and operate manufacturing facilities where necessary to prove the commercial feasibility of volume production, and otherwise promote the finding, development, and commercial use of new, increased, extended and perfected processes, techniques, and programs for industrial use of greater quantities of agricultural products.

POWERS OF THE ADMINISTRATION AND THE ADMINISTRATOR

SEC. 5. The Administration is authorized to—

(a) utilize such existing facilities of the United States, and such trained personnel employed by the United States, as the President finds can feasibly be transferred to the Administration for carrying out the purposes of this Act. The President is hereby authorized to (1) transfer any such facility, facilities, or personnel to the Administration, or to (2) make any such facility, facilities, or personnel available to the Administration for carrying out the purposes of this Act;

(b) build, purchase, or lease plant facilities, or necessary equipment, suitable for research, pilot plant, manufacturing, or other needs of the Administration in carrying out the purposes of this Act;

(c) employ such personnel as may be necessary to carry out the purposes of this Act; and all technical or scientific employees engaged for research by the Administration shall be exempt from the civil service laws and regulations; and

(d) employ or retain on a contract basis individuals, firms, institutions, and organizations, public and private, including land-grant colleges and universities, to conduct research programs for the Administration pursuant to this Act.

SEC. 6. The Administration is authorized to pay incentive awards to private citizens for suitable and acceptable suggestions to implement the program established by this Act, such payments to be made in accordance with previously published rules stating the amounts of, criteria for determining, and subjects of, such awards.

SEC. 7. The Administrator is authorized to appoint industry advisory committees and to employ consultants without compensation or at rates of compensation not to exceed $50 per diem.

SEC. 8. The Administration may make grants to accredited schools, colleges, and universities for fellowships and scholarships in research for the purposes of this Act.

INDUSTRIAL AGRICULTURAL PRODUCTS AGENCY CREATED

SEC. 9. There is hereby created in the Department of Agriculture an Industrial Agricultural Products Agency (hereinafter referred to as the "Agency"). The duties, obligations, and responsibilities of the Agency shall be carried out by and under the direction of the Secretary of Agriculture.

DUTIES AND RESPONSIBILITIES OF THE AGENCY

SEC. 10. Under the delegations, directives, and policy determinations of the Administrator, the Agency shall carry out all of the duties, obligations, and responsibilities imposed upon the Administration by this Act, including the making of research contracts, employment of personnel, contracts for the construction, purchase, lease, or other acquisition of real or personal property, and the maintenance of all records, files, studies and other data undertaken pursuant to this Act. Notwithstanding any other provisions of this Act, the Administrator may delegate any power given him hereunder to the Agency, and he may control, supervise, and direct all Agency action permitted by law under this Act.

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APPROPRIATIONS

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Mr. ABERNETHY. We would be happy to hear from you at this time, Mr. Harvey.

## STATEMENT OF HON. RALPH HARVEY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

Mr. HARVEY. Mr. Chairman, on behalf of myself and many others, I wish to thank you for your courtesy and thoughtfulness in scheduling this hearing.

While it appears certain this session of Congress is about to conclude, surely the subject matter of the proposal before us deserves attention and consideration.

Although H. R. 10125 bears my name as author, its sponsorship can be widely credited. In its present form it was first introduced as S. 3503, with 33 Senators joining the Honorable Homer E. Capehart in its sponsorship. On this side of Capitol Hill, numerous House colleagues have advised me of their approval of the bill's aim, and four of them—Representatives Adair, Beamer, Bray, and Harden—have offered duplicate proposals.

The subject of H. R. 10125 is that of research—research of a type that will broaden the industrial and commercial uses of farm production, particularly farm commodities in surplus.

On this occasion, Mr. Chairman, I believe we sense the irony of the American farm problem. Mankind, since the dawn of recorded history, has known no greater problem than that of sustaining life by protecting food from the ravages of flood and famine. But today our farms and farmers are most seriously challenged by the constant production of more food and fiber than can be consumed. The problem is more incredible with the realization that millions throughout the world are in dire want of food and clothing.

It should be noted, I think, that the Congress has acted to ease the situation. Public Law 480, for example, is operating with more and more success to help distribute our agricultural largess among needy and friendly people of the world. Only last week the President reported that United States commodities, valued at more than a billion dollars, had been disposed of by means of this legislative act.

But the surplus-disposal law, like earlier enactments limiting crop production and the more recent one creating a soil bank, must be recognized for what it is—a temporary device that promises no permanent solution of the basic problem. I am one of those, Mr. Chairman, who feels sure our farmers are no different than other productive Americans—deservedly most happy and prosperous when they are producing to the maximum of their ability, with due regard for enlightened practices of conservation in order to preserve the fertility of the soil for future generations.

The employment of scientific research as an aid to agriculture is not new in our history. Legislation creating our land-grant agricultural colleges was enacted 94 years ago and, through nearly a century of research activities under Government direction, we have witnessed amazing advancement in the productivity of our farms. This progress has released millions of people from the cultivating of food and fiber to work in the factories and mills of industry, and thus accounts for today's high standard of living.

But is it not apparent, Mr. Chairman, that the time has come to shift the emphasis of agricultural research? In the face of mountainous surpluses, we are spending this year about eight times as much money for still greater production than we are to find new and extended uses

for the crops we have. H. R. 10125 is urged as a practical and realistic expression of faith in our ability to find new and enriching industrial uses for the output of modern-day farming. Surely, in terms of our national well-being, we need not to produce more but to realize more from all we produce.

At present we have four regional laboratories, each devoting limited funds and modest manpower to scientific research. Their work, much of it impressive, is divided between the search for better production and new utilization of existing production. I certainly am not complaining about the work that has been done—it is conceded that a great deal of good has accrued from both types of research—nor would I wish us to abandon research in methods to increase the productivity of our farms. What I am saying is that we need now to concentrate more of our resources upon research for new and broader utilization of farm production.

Research for use, some will say, is going on daily, thanks to the laboratories of private industry. But is this enough? I would not want to be in the position of saying that such research is not good, because I think it is. What I am saying is that this type of research is not dedicated to a solution of the overall problem, which is the lack of industrial use of the surplus products we have.

Perhaps I can illustrate my point by citing the several great industrial concerns who are currently seeking to devise substitutes for cotton. Now cotton is one of our surplus problems, and the economic welfare of millions of people is dependent on cotton. Surely research is a matter of future concern to them, because cotton growers themselves cannot conduct a research program. We should at least try to help them hold their own in a fiercely competitive race by seeking new and better uses for cotton.

We have seen tremendous progress come about in the utilization of soybeans which is a newcomer in terms of the long range agriculture picture. Our Midwest regional laboratory, located in Illinois, has made some very worthwhile contributions with regard to better uses for soybean byproducts, and this has meant millions of dollars to the agriculture of the Nation. I cite this as a good example of the potential of utilization research, but the program of research in my opinion has to have much more emphasis and much more money for its use.

I know that the Department of Agriculture has historically supervised all agricultural research even into commercial utilization and I believe they have given to this activity the very best support. My bill, however, provides that there shall be set up a separate administration for industrial-agricultural research and it is given certain powers, duties, and responsibilities. The members of this agency shall be subject to appointment by the President and the members shall serve at his pleasure. The administration which my bill would create is to conduct scientific research, maintain and expand pilot plants wherever necessary, operate manufacturing facilities to prove the commercial feasibility of volume production, and in every way promote the finding and development of commercial uses of agricultural products.

I think, Mr. Chairman, that such an agency for budgetary reasons alone can proceed more expeditiously if operated independently of the Department of Agriculture. But whether the Congress in its wisdom finally concludes to approve the provisions of my bill or amend it to

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make it a continuing but considerably expanded segment of the Department, the main thing I want to stress here today is the urgency for action. We have great potential and I would simply call to your attention one editorial that appeared recently in one of the leading newspapers of my district. The Greensburg Daily News, the edition of April 9, 1956. This editorial is entitled "Corn Product May Waterproof Soil Roads," and with your permission, Mr. Chairman, I would like to include it in my statement.

Mr. ABERNETHY. It may be so included.

(The editorial is as follows:)

[From Greensburg Daily News, April 9, 1956]

CORN PRODUCT MAY WATERPROOF SOIL ROADS

Research of Indiana scientists has resulted in the development of a chemical which may be used to waterproof soil roads.

DDAC, as the chemical is known, can be made from corn. A research team of the Union Starch & Refining Co., at Columbus, in cooperation with the chemical division of Armour & Co., has developed DDAC as a soil stabilization agent.

Researchers have found that DDAC tends to harden many different types of soil. It can be sprayed onto soil roads or onto foundation soil beneath paved roads. It will cost about $3,500 to treat a mile of subgrade soil on a road 22 feet wide.

Already, motorists on two sections of highway in Indiana are driving over a roadbed treated with the corn product. Researchers are waiting to see how the soil holds up under a full year of freezing and thawing, wind and rain.

If the chemical proves successful, several important advantages will come from its use.

DDAC could prove an important factor in lowering the cost of highway construction and maintenance, saving vast sums of money to taxpayers and providing improved roads.

It could also be used to treat such dirt surfaces as farm yards and lanes and tennis courts.

Even more important, it would use vast quantities of corn, now produced in surplus quantities. DDAC, if successful, could aid greatly in solving the great economic problem involved in surplus corn production.

Hoosier Gov. George N. Craig is enthusiastic about the possibilities of DDAC. He pointed out that the reason that the price of soybeans has held up is because science has found how to use this farm product in making paint, plastics, medicine, and cloth.

As stated by Governor Craig, new uses must be found for other agricultural products, including corn.

Development of DDAC forms a forward step on the part of scientists in the creation of a new product which will use corn surpluses. If successful following exhaustive tests, DDAC could prove to be an outstanding example of how scientific research is contributing to improvement of the Nation's economy.

Mr. HARVEY. Before concluding, Mr. Chairman, I wish to remind the committee that the present estimated cost of storing our surplus farm commodities is $1 million a day. It seems to me that all taxpayers, those of the city as well as the country, would much prefer that we devote at least a percentage of such a sum to the more intelligent cause of trying to find new uses for the surpluses rather than continue to pile them up with little hope for their eventual use.

We have tremendous productive potential and we have also great know-how for utilization, but we have not proceeded as fast with our utilization program as we have with our production. Now the net result of all of this will be inevitably a higher standard of living not only for our American people but for all the world because everyone profits from the benefits of new knowledge and this is essentially what we are attempting to do, to find new facts which can be helpful and

worthwhile. I am not going to proceed longer, Mr. Chairman. I feel very definitely the urgency of action in the field of utilization research and I trust sincerely that the committee will see fit to approve this legislation so that we may embark upon a program that in my judgment has been too long delayed.

Mr. ABERNETHY. Mr. Harvey, your statement is appreciated. I should like to say first that I think the Committee on Agriculture should feel indebted to you and your colleagues who are sponsoring this legislation. I say that for the reason that I think the research that we have carried on so far in the field of production has been fine, and I certainly would not want to minimize or reduce any of that work and activity. However, I am one who believes and who has said many times in the last 2 or 3 years, when the subject of surpluses has been discussed, that we are not lending sufficient emphasis to the utilization of farm products produced as the result of research production.

Some criticism has been handed our farm people for producing so much. The word "surplus" has become sort of a dirty word all around the country. The facts are, I think, the Congress of the United States is as much responsible for the surpluses, if not more so, than the farmer. We put legislation on the books and sent experts out to teach them how to grow these crops, and they have really learned how to grow and produce them. As a result of production research the warehouses have been filled. They were filled because they have taken the benefit of the legislation we passed. As a result they have learned to grow 2 stalks and 2 ears of corn and 2 bolls of cotton where they used to grow 1.

I think there is some possibility in this legislation. I have not studied the details. I imagine, with the gentleman's wide knowledge of the subject, it is probably perfect. I do not know.

I sincerely think you have rendered a real service in bringing this legislation to the attention of the Congress and to the people.

Mr. HARVEY. Mr. Chairman, it should be noted, I think, that there was a provision in the soil bank legislation passed recently by the Congress which does make a modest beginning on a more direct and constructive approach.

I noticed in one of the little leaflets that was distributed regularly on our desks an item just this morning in which it is stated that the President has nominated a five-member bipartisan commission to study new industrial uses for farm production. That provision, which was carried in the soil bank legislation, certainly had the approval of all the members of our committee. I am whole-heartedly for it.

However, it does seem to me that we have just been neglectful about pushing the research for use. I served on a subcommittee in my own State before coming to Congress, on the study of ways to implement the provisions of the Hope-Flanagan Act, which was the Research and Marketing Act, I believe. That is correct, is it not, Mr. Heimburger?

Mr. HEIMBURGER. That is correct.

Mr. HARVEY. We looked into all phases of food production and distribution in my State. Even in that area we were constantly finding ourselves coming up with new ways to make a better product, but we were singularly, it seemed, derelict in finding a broader market for the products we were producing.

I just call your attention to reports that have come to my desk. I am sure they came to all of yours. One of them is entitled: "Agricultural Research, June, 1956." And the other is a report from the Agricultural Research Center, Handbook No. 43, a current report from the Agricultural Research Service of the United States Department of Agriculture.

As you go through those, you see they are very well prepared and they are excellent reports. I am again impressed with the preponderance in those reports of the effort that is being placed on production. I am not saying that in a critical sense; I think it is just a statement of fact. It is just further evidence of how we have been doing this work. It is so challenging and so interesting to try to figure out new methods to produce more, and we just do not put our minds and our talents to the problem of how to make better use of what we have.

Mr. DIXON. Mr. Chairman?

Mr. ABERNETHY. Dr. Dixon.

Mr. DIXON. I am intrigued by the major premise of our colleague, Representative Harvey, which is that the larger part of our agricultural legislation today is not the permanent solution; it is just a bridge to try to tide us over to something better.

I do not think nearly enough emphasis has been placed upon that great truth. We must soon find something more fundamental than high support prices and other stopgap measures. We must reach a cure. I believe in research we have promise of a permanent solution, if equal emphasis is placed upon research and production. I think this research in the broader use of agricultural commodities and more research in the marketing of agricultural commodities will go a long way to solve our problem and to solve it permanently.

I have in mind a little piece of research that I supervised on feeding sugar to livestock. We had about 500 head of beef in that experiment, and also flocks of turkeys. We found that 30 cents' worth of sugar would produce a dollar's worth of beef. That was when beef was a little higher than it is now, however.

The experiment opened my eyes to the great opportunities that lie ahead in research.

I certainly commend the gentleman on his statement and on promoting this fundamental concept in agriculture.

Now, there are one or two things in the bill about which I should like to ask our colleague a question or two. What is the justification for this new administration to be set up by the President for research?

Mr. HARVEY. Dr. Dixon, I know that you have been president of the Agricultural University in your own State and have, therefore, been very close to this problem of education as well as research.

In my statement I said, quite frankly—and I think it is true—the chief justification is one of emphasis. The Department of Agriculture has a great deal of difficulty budgetwise, as you and I both know, to make any substantial deviation in its budget from year to year. In order to really begin to achieve the necessary attention and the intense activity which I think is justified in order to get the proper emphasis, it would probably have to be operated and financed apart from the Department of Agriculture.

This is primarily a problem of getting proper emphasis, budgetwise, Dr. Dixon, which I think justifies the approach.

Mr. DIXON. As I recall, last year the Congress forced the Department of Agriculture to take more money than it requested.

Mr. HARVEY. Yes. I do not think it was in the area of research, though, Doctor, was it?

Mr. DIXON. Don't you think we could easily sell Congress on the value of research as one of the permanent solutions to the farm problem?

Mr. HARVEY. I said in my statement that if the Congress in its wisdom concluded that it did not want to establish a separate agency, that certainly we are going to have to take a revised approach to the position within the Department. So long as we go ahead with the present approach, budgetwise, with the necessity for looking at the total overall Department of Agriculture budget each year, unless we are able to highlight this particular phase of it, we will eventually wind up trying to keep this budget within the same bounds it had the year before and the year before that.

I might say that I served as a budget officer for our State before coming to the Congress, and I know quite well the general psychology of budget officers. That is the reason why I feel that unless we have some way to highlight it and put more emphasis on it it will present a difficult problem.

The senior Senator from Indiana described this as a "crash" program. I do not quite go along with that terminology, because I do not believe research is something you can "crash" but I do think it is something which can have more emphasis.

Mr. DIXON. Unquestionably. I have in the back of my mind our wonderful system of land-grant colleges, with all the Federal collaborators and State research people, with all their large laboratories and with their fine administrators and executives trained all of their lives in this field, with the States themselves putting up so much of the money. While this $100 million would come from the Federal Government alone without stimulating the States to extend themselves, I think that the incentive factor of the States through the land-grant colleges would maybe double, triple, or quadruple the amount of money we could get invested in this type of research. That is why we should channel the research through the Department of Agriculture.

Mr. HARVEY. Well, we have the four regional laboratories. I think that there is no one who is more devoted to the fine efforts of the land-grant colleges than I am, Doctor. I am a graduate of our own land-grant college and I served on the extension staff of that college at various times during the years after I graduated. I am not at all minimizing the importance of our land-grant colleges in this overall program.

Mr. DIXON. Do you not think this Federal emphasis alone would cause them to ease back and say: "Well, let the Government do it."

Mr. HARVEY. I would say this: With respect to my knowledge of land-grant colleges most of our research in those institutions is devoted to better methods of production and marketing. I say that in all kindliness, but I think you will agree with me that is true.

Mr. DIXON. I will agree.

Mr. HARVEY. This is a peculiar type of research, Doctor, in my mind, which I envision. It is a highly specialized type of research.

It is not even maybe the kind that can be farmed out to our land-grant colleges. It may have to be concentrated in one of our regional laboratories and it might involve the building of pilot plants and even maybe a small factory to demonstrate not only the facts that research has brought out but to prove their economic feasibility. Sometimes those are rather expensive operations, but I think they offer opportunity to pay off.

I doubt very much if you could farm that kind of an activity out very easily to our land-grant colleges.

Mr. DIXON. The land-grant colleges are now cooperating on a regional basis quite successfully.

Mr. HARVEY. I think that is true.

Mr. DIXON. Maybe money like this would stimulate that. Also there are rather local and regional needs that maybe the central laboratories overlook, which the regions could promote more enthusiastically than the central agencies.

Mr. HARVEY. I think there is no doubt that we have a great deal of effective work being done at our land-grant colleges. I would not want to minimize or reduce that at all.

I am thinking here in terms, really, more of a highly specialized type of utilization research that could, in my opinion—and I do not presume to be an authority on it—very well need to be centralized. Some phases of it, as the work proceeds, then could be farmed out. I think the impetus should come from a centralized source.

Mr. DIXON. Thank you, Mr. Chairman, and Mr. Harvey.

Mr. ABERNETHY. Thank you, Mr. Harvey.

Mr. HARVEY. Thank you, Mr. Chairman.

Mr. ABERNETHY. We will insert in the record at this point statements from Hon. William G. Bray of Indiana, Hon. Cecil M. Harden of Indiana, Hon. E. Ross Adair of Indiana, and Hon. John V. Beamer of Indiana, authors of the other bills under consideration by the committee.

(The statements are as follows:)

STATEMENT OF HON. WILLIAM G. BRAY, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

I am appearing today in behalf of this measure to expand research into the uses of agriculture products because I believe this is of great importance not only to agriculture in America but to our entire economy. A long-range solution to the problems of overproduction must be found to bring stability to the farm economy. It must also be found to lighten the expense to the taxpayer of taking care of crop surpluses. I believe research can be the answer to both of these problems; and in addition we will find products and uses which will further enhance our standard of living.

The work of George Washington Carver is the classic example of what ingenuity and industry can produce. He expanded the uses and consequently the demand for peanuts to such an extent that production doubled in a generation. The peanut crop is a primary source of income to southern agriculture today.

His work at Tuskegee Institute went far beyond the peanut, however. He used poor soil and overlooked plants and herbs and proved they could sustain people who would make use of them.

He contributed to the growth of farming techniques which has been phenomenal in the last half-century. But most of our improvements have been directed to increasing the yield and improving the crop; we have not given enough attention to finding uses for these products besides human consumption for food.

That is the purpose of this legislation: to find uses for our surplus agriculture products that will help to compensate for the increased production brought about

by research in our schools and research, resourcefulness, and industry on our farms.

The possibilities are endless. Metallurgical oils apparently can be developed from grains. Synthetic rubber can be made from grain, and further development might reduce the cost to a practical level. From the gluten in grain a natural rubber may be produced. If grain-made ethyl alcohol were blended with gasoline for automobiles it would consume a tremendous quantity of grain.

There are nonindustrial uses which should be studied. Powdered whole milk, a near fact, would expand the dairy market.

The new program would give fresh impetus to existing research programs, which are excellent but do not have the scope which is justified by the problem and the potential. The new efforts could largely be channeled into existing facilities, but with more emphasis and more Government support. One of the primary benefits of a program such as that proposed in this bill would be the impetus given to present research. By that I mean a shove in the right direction can move it more readily onto the course we all seek to achieve.

The cost of such a program should be compared with the cost of present farm programs which have not been an overall solution, and with the potential benefits which are really incalculable.

I hope Congress will act quickly to expand such research in the interest not only of agriculture but of the entire Nation.

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STATEMENT OF HON. CECIL M. HARDEN, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

Mr. Chairman and members of the committee, as you know, the bill I introduced is a duplicate of bills submitted by several of my colleagues and one on which the principal research was done by Senator Homer E. Capehart and introduced in the Senate by Senator Capehart and others.

Briefly stated, H. R. 10123 would provide for an accelerated program of research into increased and additional uses in industry of agricultural products grown on American farms.

Need for increasing our research into industrial uses for farm products has, I believe, been recognized by leaders of agriculture for many years. My good friend and former fellow townsman, Mr. Wheeler McMillan, vice president of Farm Journal and Country Gentleman magazine, has repeatedly urged action along these lines. Other farm publications have evinced similar interest.

Within the past few days, President Eisenhower has announced the formation of a five-member bipartisan commission to study new industrial uses for farm products, concrete evidence of the President's interest in this vital field of research.

The United States Senate earlier this month held hearings on this measure introduced by Senator Capehart and heard supporting testimony from several of the major farm organizations and from Department of Agriculture officials.

The agricultural situation in America today is unique. While major areas of the world suffer from underproduction of vital foods and fibers, our problem here in America is one of overproduction. American farmers, by means of hard work, improved techniques, and better know-how, are producing more than our markets can handle.

This overproduction—or, as I would prefer to call it, this underconsumption—has caused a decline in the level of prices paid for farm products. To halt this decline, Congress and the administration have joined in amending our price-support laws and in testing out the new soil-bank program.

These are, however, but temporary measures. The cause, as I said, of low farm prices is overproduction or underconsumption. The cure, therefore, can only be to increase consumption.

That is the purpose of my bill to seek out new industrial uses for farm production. Our expanding industry, with its expanding needs, might easily absorb great quantities of agricultural products now not commonly used in industry if we through research can find new uses.

Our overproduction problem could well vanish overnight should research uncover just one new major industrial use for crops such as wheat, corn, and soybeans.

Searching for that one new outlet—or for many outlets—for farm goods is the purpose of my bill. We all know the problem. This bill, if enacted, might give us the answer we all so earnestly seek.

Thank you, Mr. Chairman and members of the committee for considering this important legislation and for this opportunity to express my views.

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STATEMENT OF HON. E. ROSS ADAIR, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

Mr. Chairman, to you and the members of the House Committee on Agriculture, I wish to express my sincere appreciation for your courtesy and consideration in holding these hearings on S. 3503 and companion bills, including H. R. 10145, the measure I introduced concerning farm research, and providing for a long-range farm program.

Without question, agriculture is the backbone of our economy. When the farm community prospers, the entire Nation prospers. During the last 20 years, we have seen farmers in various stages of prosperity or economic perplexity because of the shifting currents in our economic stream.

Before the adoption of a basic farm-crop law, the farmer was having extreme economic difficulties. With the farm program and the advent of World War II, the farmers had a windfall, and farm prices soared and farmers prospered as they met the growing need for food and fiber in the fight for victory.

Now, we are entering another stage in the postwar era with farm prices having taken a downward turn and surpluses mounting. Consequently, the farm community has been facing an economic pinch while the rest of our economy is booming.

It was with this in mind that I joined with other Indiana colleagues in introducing this farm-research legislation. It was first proposed by our senior Senator from Indiana, the Honorable Homer E. Capehart in the Senate. Thirty-three of his colleagues joined with him there in presenting this legislation.

Primarily, this provides for a scientific research program which would develop uses for surplus farm products in industrial production.

Representing, as I do, a farming area with diversified crops and livestock, I have found much evidence to support such legislation. Agriculture needs to continue to find new uses and purposes for its tremendous production potential. If we can turn our energies and intelligence into discovering manifold uses and new products from farm crops, we can assure the future prosperity and welfare of all of our people.

There have been great strides made in the past in farm chemurgy, but it seems to me that it is time for us to step in and assist in developing the future role of agriculture to meet the continuing increasing needs of our population, and the world's, for better and healthier citizens.

I believe this can be accomplished, and, at the same time assure the future soundness and expansion of agriculture by the passage of this farm-research legislation. Industrial uses will be discovered to convert our farm surpluses into valuable and useful products; the taxpayers will be saved millions of dollars now going into wasteful channels because of the tremendous cost of storing these surplus crops, and there will be every reason to utilize more of our citizens in the rural areas producing the crops and products necessary to keep pace with the new uses found for all farm products.

This legislation is the opening wedge to develop such a program. Its size necessitates it being undertaken by the Congress. Mr. Chairman, the consideration of the members of the House Agriculture Committee is urgently needed in pushing this legislation to enactment. In turn, the money spent for research and development will be instrumental in restoring farming to its proper role in our economy and at the same time providing for a stronger, healthier, and growing farm prosperity.

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STATEMENT OF HON. JOHN V. BEAMER, A REPRESENTATIVE IN CONGRESS FROM THE STATE OF INDIANA

Mr. Chairman, I appreciate the opportunity of appearing before your committee in behalf of H. R. 10148, a bill to provide for a scientific study and research program for the purpose of developing increased and additional industrial uses

of agricultural products so as to reduce surpluses of such products and to increase the income of farmers, and for other purposes.

My interest in agriculture stems from many sources. First of all, I was born and raised on a farm and agriculture continues to be my personal main source of revenue and income. I also have the privilege to represent the Fifth Indiana Congressional District which boasts of some of the best farmlands in the United States. Real estate is at an all-time high in this area and farmers and all business dependent upon agriculture continue to express a keen interest in the welfare of agriculture.

It has been possible for me to meet with many farmers and small-business men and by means of these visits, questionnaires, and exchange of letters, I feel confident that all the people in our part of the State are keenly interested in this type of legislation. Early this year I introduced H. R. 8586, a bill to amend the Internal Revenue Code of 1954 to relieve farmers from the excise tax on gasoline and lubricating oils used exclusively in farm tractors or farm machinery and for other agricultural purposes. The principles involved in this bill are incorporated in Public Law 466.

I also introduced H. R. 10742, a bill to provide for the protection and conservation of national soil, water, and forest resources and to provide an adequate, balanced, and orderly flow of agricultural commodities in interstate and foreign commerce, and for other purposes. A similar bill, H. R. 10875, which authorizes $1.2 billion for a voluntary soil-bank program to reduce production acreage of crops in surplus supply, fixes feed-grain supports at 76 percent, and encourages disposal of surpluses at home and abroad, was passed by the Congress and now is Public Law 540.

All of these measures and numerous other worthwhile attempts on the part of the 83d and 84th Congresses to be of assistance to the farmer are appreciated and are recognized as necessary for reasonably immediate benefits.

However, it is felt that the future of agriculture must be a long-range program. The rapid rate of growth of our population, the changing tempo of the times, the remarkable discoveries and uses of new products, marketing conditions, and similar subjects, present the greatest challenge to this segment of the economy.

It seems to be entirely in line with traditional American initiative to endeavor to study new approaches and new methods for any problem that presents itself. For example, private industries are constantly employing research in order to improve their products, to build up consumer acceptance, and to create new markets.

The agriculture colleges, the United States Department of Agriculture, and various private and public institutions have made it possible for the farmers of this country to produce more and more of their products with fewer people and in less time. The modern tractors have replaced the horses in the same manner that hybrid corn with its increased yields, for example, has replaced the open-pollinated corn of former years. The farmer has proven that he can produce both quality and quantity to meet any emergency that might arise.

However, after an emergency such as the recent war has passed, the farmer has found himself with this high productive capacity that exceeded the demand for his goods. The idea of raising demand to meet production instead of pulling down production to meet demand is the course that has made this Nation great.

The potentialities for research for new uses of agricultural products are almost unlimited. The purpose of this bill and other bills of a similar nature which have been introduced is to increase scientific research by the use of Federal money.

It seems to me and to farmers with whom I have talked that a reduction in output in the long run would not help the farmer and might confront the Nation with a shortage in a sudden emergency. This program if brought to a successful fruition would permit the farmer to produce perhaps in greater quantity because the market would not only be adjusted but also be trained and educated to use more and more of these agricultural products.

The specific suggestion in the bill is that research facilities both private and public including those of land-grant colleges and universities should be used for an all-out attack on the developments of increased and additional industrial uses of agricultural products. This is a research program that would not cost a great sum of money comparatively speaking and one which would be more than offset by increased revenues resulting from increased earnings of both farmers and those who sell goods, wares and merchandise to farmers. It also would help to

eliminate the expensive and burdensome cost to the Government for its present surplus storage program.

Briefly, the bill would create in the executive branch of the Government an Industrial Agricultural Products Administration. This Administration would be appointed by the President with the advice and consent of the Senate. Their duties would be to conduct research of various types, make tests, maintain and operate pilot plants whenever necessary, and to maintain and expand such facilities that would enable the research program to secure the necessary results.

Another provision would authorize this administration to pay certain incentive awards to private citizens for studies in research marketing and other phases of agricultural work. Grants would also be made to accredited colleges and universities and fellowships and scholarships for research for the purposes of this act.

There are many other minor phases of this program but the entire purpose is to make possible a means of finding more uses for the farmers' goods and to create a large market and provide a ready acceptance for improved agricultural products resulting from such studies.

It is recommended that the sum of $100 million be appropriated for this specific study in order to initiate this program. It is felt that this type of research for the farmer will result in the correction of a fundamental error in the philosophy of helping agriculture. Instead of reducing production and instead of creating a scarcity, it then will be possible for the farmer and the manufacturer of agricultural products to increase production because there will be an increased demand for their goods.

Mr. ABERNETHY. The next witness will be Dr. Clarkson.

## STATEMENT OF DR. M. R. CLARKSON, DEPUTY DIRECTOR, AGRICULTURAL RESEARCH SERVICE, DEPARTMENT OF AGRICULTURE; ACCOMPANIED BY DR. G. E. HILBERT, DIRECTOR OF UTILIZATION RESEARCH; AND S. LEJKO, CHIEF, BUDGETARY REPORTS SECTION

Dr. CLARKSON. Mr. Chairman, I appreciate the opportunity of appearing before you today to discuss the House bills providing for a scientific study and research program to develop increased and additional uses of agricultural products that will reduce surpluses and raise the income of farmers.

These bills would provide for research to find and develop new industrial uses and increased uses of agricultural products. They would also create in the executive branch an Industrial Agricultural Products Administration to carry out the purposes of these acts. The Administration would be headed by an Administrator who would receive compensation at the rate of $22,500 per annum. The Administrator would direct the conduct of research and other scientific experiments in an all-out effort to promote the finding, development, and commercial use of new, increased, extended, and perfected processes, techniques, and programs for industrial uses of greater quantities of agricultural products.

The bills, as introduced, would authorize the following: (1) The use of existing facilities and personnel, (2) construction of new facilities and hiring additional personnel as needed (all technical and scientific personnel engaged for research would be exempted from civil service laws and regulations), (3) entry into contractual arrangements, (4) payment of incentive awards, (5) employment of consultants without compensation or at rates of compensation not to exceed $50 per diem, and (5) grants to accredited schools for fellowships and scholarships in research for the purposes of this act.

The bills, as introduced, would create in the Department of Agriculture an Industrial Agricultural Products Agency under the direction of the Secretary of Agriculture. It would carry out under the delegations, directives, and policy determinations of the Administrator, all of the duties, obligations, and responsibilities imposed upon the Administration by these bills.

The introduced bills would authorize, for the Industrial Agricultural Products Agency, an annual appropriation of $100 million beginning with fiscal year 1957. It would also authorize the President to transfer $1 million out of unexpended Agricultural Department funds to promptly initiate the program following the bill's enactment.

Mr. ABERNETHY. Doctor, may I interrupt? I probably should have asked this question of Mr. Harvey, but is that authorization in addition to the authorization now in the Hope-Flanagan Act?

Dr. CLARKSON. We so construe it.

Mr. ABERNETHY. All right. Proceed.

Dr. CLARKSON. The idea of developing, through research, up-to-date utilization of farm commodities is not new, of course, but never before has an attack on farm surpluses through research, as proposed in these bills, been tried on so large a scale. We will not pretend that research will solve the present surplus problems all by itself. We shall certainly need all other programs and tools that may be found useful for handling surpluses. But there is no doubt that large-scale research is one of the most important tools at our command. It is unrealistic to assume the future of agriculture must be one of chronic surpluses. As members of this committee are well aware, favorable markets always have been a master key in opening up periods of farm prosperity.

To solve the surplus problem, we must expand markets. We have three possibilities for doing this: (1) Stretch the export market as far as we can; (2) increase per capita consumption of higher quality foods; and (3) devise new uses for established crops and develop new crops with good market potentials as alternatives to those in surplus. We must use all three.

With respect to the first possibility, the Department is engaged in a full-fledged drive to open up new markets abroad, and considerable success has been attained.

In 1955, the exports of agricultural products increased 5 percent in value and 11 percent in quantity over 1954. Government programs include stimulation of commercial sales for dollars; sale of surpluses for foreign currency; food and fiber donations; loans of the Export-Import Bank; and barter of farm products for strategic materials. These programs accounted for about a third of the export volume.

Despite these successes, we cannot depend on a repetition of the circumstances that 50 and 75 years ago made exports a major outlet for our marketable farm goods. While export markets will always be important, new and expanded markets will most likely come largely from our own economy. And this brings us to the other two possibilities.

Consider briefly the possibility of increasing per capita consumption of higher quality foods. As you know, nutritionists consider high quality diets as those containing adequate amounts of meat, eggs, milk, and other livestock products, and fruits and vegetables. There has been a strong trend toward more minerals and vitamins, as well as

proteins, in our diet the past dozen or 15 years, and this trend is becoming stronger. This means the demand for livestock products is likewise increasing.

There is much to be said for attacking surpluses of cash crops by research to improve efficiency of livestock and feed production so that farmers can profitably supply this expanding market. The Department recognizes this opportunity and sizable increase for livestock and forage work have been provided in the Department of Agriculture Appropriation Act for 1957.

The bills being considered today deal directly with the third research possibility for attacking surpluses—that of creating new uses for established crops and developing new crops with good market potentials as alternatives. The Department is in full accord with this objective. We offer several suggested revisions which we believe would make it possible to more readily achieve the purposes of the bills and are necessary to effectively implement them.

With the committee's permission, I would like to present a copy of the redrafted bill which the Department believes would be necessary to get the job done if an all-out effort is to be made to develop new and improved uses for agricultural products through research.

I believe, Mr. Chairman, copies of that redraft have been made available.

Mr. ABERNETHY. I have a copy. Do you gentlemen have copies?

Dr. CLARKSON. If not, we have them.

(The redraft bill is as follows:)

A BILL To provide for further research relating to new and improved uses which offer expanding markets for farm products, and for other purposes

*Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Congress of the United States hereby makes the following declarations and findings concerning the development of new and improved uses for farm products and for new products to replace those now in surplus:

(a) Farms in the United States have a capacity to produce more farm products than can be marketed at prices that will return sufficient incomes to farmers to maintain an efficient and progressive agricultural industry.

(b) A prosperous and progressive agriculture will contribute immensely to national welfare by efficient production of needed food and fiber, by provision of raw materials for the transportation and processing industries, by purchases of production supplies, and by its contribution to maintenance of a balanced and high level national economy.

(c) National defense and security interests of the United States require protection of agricultural resources against deterioration and the maintenance of high productive capacity in order to meet possible emergency needs of the United States and other friendly nations.

(d) Research programs to develop new and improved uses for farm products and new farm products have potentialities for providing outlets for a larger volume of farm production. This in turn will result in higher prices and incomes for farmers.

(e) Public and private research agencies, including the Department of Agriculture, the Land-Grant Colleges, other universities, and research institutions, as well as private firms, can and should be utilized for an "all-out" attack on development of new and improved uses, and new and extended markets and outlets for farm products and byproducts. Research, pilot plant and developmental work and corollary economic and related studies should be devoted to the expansion of industrial uses for agricultural commodities in surplus, and to any food and feed uses and replacement crops that can make substantial contributions towards the solution of the surplus problem. Facilities should be established, as needed, to permit adequate experimentation and testing, and production and market development, of promising new uses and new products.

(f) Development of new and improved uses of farm products and new farm products and new and extended markets and outlets for farm products and by-products will enlarge income opportunities for farmers. It also will reduce Government costs for acquisition, storage, and ultimate disposition of commodities now in surplus.

SEC. 2. The Secretary of Agriculture is authorized and directed to conduct research into the finding of new, increased, extended and perfected uses for farm products, and of new farm products, and to make laboratory and field studies, test production and marketing procedures on commercial bases, maintain and expand pilot plants where necessary, utilize commercial plants and such other means and methods as the Secretary deems will accomplish the objective of this Act.

SEC. 3. The Secretary of Agriculture shall have the authority within the limits of available appropriations under the Act to carry out the provisions of this Act, including, but without being limited thereto, the authority:

(a) To prescribe such rules and regulations as he deems necessary governing operations under this Act.

(b) To enter into contracts through the means provided in section 10 (a) of the Act of August 14, 1946 (60 Stat. 1085).

(c) To make grants to State agricultural experiment stations, colleges, universities, and private nonprofit research institutions for the conduct of research pursuant to this Act.

(d) To acquire by construction, purchase, lease, loan, or gift, real property needed to carry out the purposes of the Act.

SEC. 4. The Secretary may appoint and fix the compensation of such personnel as may be necessary to carry out the provisions of this Act. Such appointments shall be made and such compensation shall be fixed in accordance with the provisions of the civil-service laws and regulations and the Classification Act of 1949, as amended: *Provided*, That the Secretary is authorized to fix the compensation for not more than 100 positions established to carry out the purposes of this Act or other Acts authorizing utilization research in agriculture which require the services of especially qualified scientific or professional personnel: *Provided further*, That the rates of basic compensation for positions established pursuant to this section shall not exceed the maximum payable under the Act of August 1, 1947 (61 Stat. 715), as amended and supplemented, and shall be subject to approval of the Civil Service Commission. Positions created pursuant to this section shall be included in the classified civil service of the United States, but appointments to such positions shall be made without competitive examination upon approval of the prospective appointees' qualifications by the Civil Service Commission or officer or agents as it may designate for this purpose.

SEC. 5. In carrying out the provisions of this Act the Secretary is authorized to obtain the services of experts and consultants in accordance with the provisions of section 15 of the Act of August 2, 1946, as amended (5 U. S. C. 55a) at rates not to exceed $100 per diem for individuals, and such persons may be allowed travel expenses in accordance with the provisions of section 5 of that Act, as amended (5 U. S. C. 73b–2).

SEC. 6. The Secretary shall report annually to the Congress progress on research programs undertaken pursuant to this Act.

SEC. 7. In the furtherance of the research work authorized by this Act, the Secretary may establish appropriate advisory committees to assist in effectuating specific research programs and may allow traveling and subsistence expenses of such committees in connection with their attendance at meetings called for the purposes of this Act. Appropriations made under this Act shall be available for expenses of such committees.

SEC. 8. There is hereby authorized to be appropriated the sum of $50,000,000 for the fiscal year beginning July 1, 1956, and $100,000,000 annually thereafter. There may be transferred to and merged with any appropriations made to carry out this Act such amounts as the Secretary may determine from appropriations of the Department of Agriculture available for utilization research.

Dr. CLARKSON. We are opposed to the organizational arrangements proposed in the bills for two reasons: (1) The inherent danger of conflict between the Industrial Agricultural Products Administration to be created in the executive branch of the Government and the Industrial Agricultural Products Agency to be created in the Department of

Agriculture, and (2) the apparent duplication of organization and functions between the proposed Industrial Agricultural Products Agency and the Department's Agricultural Research Service which is currently engaged in research similar to that contemplated by the bill. The redrafted bill would eliminate our objections by placing the responsibilities under the Secretary of Agriculture.

The bills provide for an immediate, large-scale program. Rapid expansion of work such as these bills authorize would require many contracts with private industrial laboratories, universities, and other institutions capable of undertaking various phases of the work. In fact, almost all of the work the first year would be done under contract. We have recommended, therefore, that appropriations, authorized at a $100 million level, should be scaled to $50 million the first year of operation.

Mr. ABERNETHY. Right there: That is in addition to your appropriations or authorizations under the Hope-Flanagan Act?

Dr. CLARKSON. That is correct.

Mr. ABERNETHY. All right.

Dr. CLARKSON. This would lay adequate groundwork for a full-scale, fully rounded program as more personnel and facilities become available. The redrafted bill includes this suggested change.

This suggested bill also contains several provisions we firmly believe must be included if this activity is to produce the expected results. Among these are (1) exemption from provisions of the Classification Act of 1949, as amended, of not more than 100 technical and professional positions as the Secretary may certify as necessary to the effective operation of the program, and (2) authority to make grants to facilitate some types of fundamental research which cannot adequately be obtained by contract. These provisions are beyond authority now vested in the Secretary of Agriculture.

Request for authority to exempt certain certified technical and professional positions from the provisions of the Classification Act is made without intent to, in any manner, impair the Classification Act or to create problems for fair, equitable, and uniform personnel administration policies or programs. I wish to emphatically state that the Department of Agriculture is in full accord with the purposes of that act. In the present matter, however, an aggressive and large program of research to attack the problem of providing satisfactory markets for substantially larger volumes of our agricultural commodities is clearly intended. We believe the successful implementation of the proposed program would be seriously impaired if such authority is not provided. The authority requested would, of course, be subject to administrative control within the Secretary's Office and the rates of basic compensation for the established positions would not exceed the maximum payable under the act of August 1, 1947, as amended and supplemented. These positions would be included in the classified civil service of the United States, but appointments to such positions would be made without competitive examination upon approval of the prospective appointees' qualifications by the Civil Service Commission or officer or agents as it may designate for this purpose.

The Bureau of the Budget advises that it would favor the enactment of this revised bill.

Attached to my statement are two tables which show a comparison of the total funds now available for research by the Department and the State agricultural experiment stations by agencies and by categories. A third table shows the funds being expended on research to develop new uses of agricultural products.

(The tables are as follows:)

***Estimated obligations for research, U. S. Department of Agriculture and the State agricultural experiment stations, fiscal years 1940, 1952, 1956, and 1957***

[In thousands of dollars]

BY AGENCY

| | 1940 | 1952 | 1956 | 1957 |
|---|---|---|---|---|
| USDA agencies: | | | | |
| Agricultural Research Service: | | | | |
| Salaries and expenses | $19,226 | $31,760 | $39,655 | $49,972 |
| Foot-and-mouth disease research | | | 1,945 | 3,500 |
| Research on strategic and critical agricultural materials | | 551 | 314 | 314 |
| Allotment from national school lunch | | 31 | 32 | 32 |
| Total, Agricultural Research Service | 19,226 | 32,342 | 41,946 | 53,818 |
| Agricultural Marketing Service | 1,265 | 4,343 | 7,159 | 8,184 |
| Forest Service | 2,092 | 6,142 | 8,237 | 10,000 |
| Farmer Cooperative Service | 260 | 275 | 278 | 380 |
| Foreign Agricultural Service | 36 | 135 | 185 | 347 |
| Library | 124 | 241 | 250 | 275 |
| Total, USDA research | 23,003 | 43,478 | 58,055 | 73,004 |
| State agricultural experiment stations: | | | | |
| Federal grant | 6,849 | 12,676 | 24,754 | 29,504 |
| Subtotal | 29,852 | 56,154 | 82,809 | 102,508 |
| Non-Federal | 12,635 | 56,884 | 78,000 | 83,000 |
| Grand total, research | 42,487 | 113,038 | 160,809 | 185,508 |

BY CATEGORY

| | | | | |
|---|---|---|---|---|
| USDA agencies: | | | | |
| Production research | $16,060 | $27,605 | $37,793 | $47,968 |
| Utilization research (See breakdown below.) | 5,374 | 11,069 | 12,551 | 15,880 |
| Marketing research | 1,569 | 4,804 | 7,711 | 9,156 |
| Total, USDA research | 23,003 | 43,478 | 58,055 | 73,004 |
| Breakdown of utilization research: | | | | |
| New uses: | | | | |
| Agricultural Research Service | 4,242 | 8,000 | 9,568 | 12,194 |
| Forest Service | 664 | 1,238 | 1,303 | 1,680 |
| Total, new uses | 4,906 | 9,238 | 10,871 | 13,874 |
| Home economics research | 380 | 1,489 | 1,549 | 1,857 |
| Other utilization research | 88 | 342 | 131 | 149 |
| Total, utilization research | 5,374 | 11,069 | 12,551 | 15,880 |

*Estimated funds and personnel related to research on new uses, U. S. Department of Agriculture and the State agricultural experiment stations, fiscal years 1940, 1952, 1956, and 1957*

| | 1940 | 1952 | 1956 | 1957 |
|---|---|---|---|---|
| Funds: | | | | |
| USDA agencies: | | | | |
| Agricultural Research Service | $4,242,000 | $8,000,000 | $9,568,000 | $12,194,000 |
| Forest Service | 664,000 | 1,238,000 | 1,303,000 | 1,680,000 |
| Total, USDA agencies | 4,906,000 | 9,238,000 | 10,871,000 | 13,874,000 |
| State agricultural experiment stations: Federal-grant | 75,000 | 103,000 | 194,000 | 236,000 |
| Subtotal | 4,981,000 | 9,341,000 | 11,065,000 | 14,110,000 |
| Non-Federal | 138,000 | 455,000 | 3,120,000 | 3,360,000 |
| Total, new uses | 5,119,000 | 9,796,000 | 14,185,000 | 17,470,000 |
| Personnel: | | | | |
| USDA agencies: | | | | |
| Agricultural Research Service | 455 | 1,337 | 1,400 | 1,650 |
| Forest Service | 177 | 220 | 186 | 240 |
| Total, USDA agencies | 632 | 1,557 | 1,586 | 1,890 |
| State agricultural experiment stations | 36 | 46 | 276 | 300 |
| Total, new uses | 668 | 1,603 | 1,862 | 2,190 |

Dr. CLARKSON. Dr. Hilbert, Director of Utilization Research, is here and is prepared to discuss our accomplishments in research related to the objectives of these bills, and also point out current work that could be expanded to develop new uses of agricultural products more rapidly.

Mr. ABERNETHY. Mr. Harvey?

Mr. HARVEY. I have some questions, Mr. Chairman. I appreciate very much being accorded the opportunity of asking the witness some questions.

I want to say that as I have followed the theme of this statement, Dr. Clarkson, it seems we are in substantial agreement as to the objective and what is necessary to be done to meet the problem. I think, as you have delineated in your statement, that you yourself agreed much more emphasis is going to have to be placed upon this phase of our present effort. That is true, is it not; much more emphasis is going to have to be placed upon it?

Dr. CLARKSON. Yes, sir.

Mr. HARVEY. And that possibly it is the fault of all who are interested in agriculture, including the Committee on Agriculture, that we have not borne down hard enough on this phase of the problem in the past.

Dr. CLARKSON. Well, I think this is one of those things that develops out of a full realization of the circumstances of today, and that the Department is in agreement that a larger effort in this field would be productive.

Mr. HARVEY. I have not had an opportunity yet to study this table which you have included with your statement, but I think this is a very important question in connection with the problem, regardless of how it is administered: Do you feel that there is talent available, to be had, to staff this kind of an effort?

Dr. CLARKSON. Well, as indicated in the statement, we believe that during the initial stages much of it will have to be done by contract with universities and concerns which are engaged in related work.

We believe that for the Department to acquire this talent—and that talent is available in this country—we will have to have some flexibility from the limitations of the Classification Act; and we are requesting in the revised bill relief from that limitation to the extent of 100 scientific positions, to be used under the judgment then of the Secretary and the Civil Service Commission, because it is in a highly competitive field of endeavor and the topnotch scientists are in great demand. But they are existent in this country; there is no question about that.

Mr. HARVEY. In other words,, you are saying that we do have available in this country enough fine scientists to staff a program of this kind. It is a question of having the legislative authority and the money to carry it out?

Dr. CLARKSON. That is correct.

Mr. HARVEY. Do you think the four regional laboratories are presently achieving their full potential?

Dr. CLARKSON. I think the four regional laboratories can achieve more with additional personnel and additional funds. They do form the nucleus by which the Department would undertake this expanded work.

Mr. HARVEY. I read the statement that was made before the Senate Agriculture and Forestry Subcommittee by the heads of the various regional laboratories, and without in any way minimizing the fine work they are doing, I was again impressed with the fact that their emphasis is not really as much on the field of utilization as I think it ought to be.

Dr. CLARKSON. Well, of course, we are talking here in terms of a greatly expanded effort that goes over the resources of those regional laboratories. I think the record will bear out the statement those laboratories have contributed very substantially to new uses and new products derived from agricultural sources which are now finding their way through commercial sources. The contribution is always one that is a team contribution. The people in the laboratories work very closely with the people in industry and the universities in arriving at a final result.

Mr. HARVEY. I mentioned in my statement, Dr. Clarkson, the fine work the laboratories had done and are doing.

Dr. CLARKSON. I appreciate that.

Mr. HARVEY. And I sincerely meant it, but again I say I think, as I try to evaluate the work the laboratories are doing, there certainly remains a great deal that can be done that is not being done. I am not criticizing any of the personnel associated with the activities. Possibly it has been the fault of us in the Congress that we just have not laid down a policy that would give the emphasis and the authority and the finances that would be worthwhile and necessary to carry out the program.

Dr. CLARKSON. There are many lines of effort which Dr. Hilbert is prepared to discuss which, if given the authority and the finances, would carry out the purposes of the legislation under discussion.

Mr. HARVEY. I would like to ask Dr. Hilbert if he has any immediate, and what he would regard as lucrative, fields that such a program could develop in the near future.

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Dr. HILBERT. I have with me a list of research proposals which are worthy of consideration in the event of a "crash" program of research to develop new uses for agricultural commodities. There are more than 20 proposals listed, and the cost of these is more than $40 million. We think all of these are projects that have a great deal of promise and are worthy of concentrated attention.

I have also a rather detailed elaboration of most of those projects, and I would be very happy to submit that for the record, if you would care to have it.

Mr. HARVEY. Mr. Chairman, I would like to ask permission to have this material included in the record.

Mr. ABERNETHY. It will be so included.

(The proposals referred to are as follows:)

UNITED STATES DEPARTMENT OF AGRICULTURE, AGRICULTURAL RESEARCH SERVICE

*Research proposals worthy of consideration in the event a crash program is to be undertaken to help dispose of agricultural surpluses*

| | Amount |
|---|---|
| 1. Production of higher quality protein supplements by fermenting cereal grains to produce microbial protein concentrates having high content of the essential amino acids, and development of low-cost processes for making highly desirable feedstuffs from barley | $2,300,000 |
| 2. Incorporation of starch into paper and paper products as an extender to meet the Nation's expanding pulp requirements | 3,000,000 |
| 3. Increased industrial consumption of starch from cereal grains by conversion to oxystarch for production of new industrial products, chemical intermediates, and superior modified starches | 2,000,000 |
| 4. Production of natural and synthetic rubbers from grain by fermentation and various chemical processing methods | 2,500,000 |
| 5. Development and testing of methods of production of choice lambs at weaning in Southeastern States to utilize surplus crop acreage | 2,000,000 |
| 6. Research on cotton and wool to develop (1) radically new machinery and methods for efficient conversion of cotton lint into new and improved fabrics for new specific end uses and markets; (2) new instruments for measuring physical properties of cotton fibers, yarns, and fabrics; (3) chemical treatments which will increase the desirable qualities of cotton products; (4) new textile and nontextile uses for cotton lint including improved nonwoven cotton fabrics and improved cotton-reinforced plastic laminates, and (5) expanded markets for wool by improvement of wool qualities through chemical modification; new wool products with enhanced attractiveness and diverse uses, and more efficient manufacturing processes | 5,000,000 |
| 7. Development of industrially practicable processes for pulping and use of fibrous plants as replacement crops for grains to extend our domestic sources of newsprint and other paper products, cordage, dissolving pulp for fiber and film manufacture, and building board | 1,300,000 |
| 8. Production and processing of safflower, flaxseed, and other crops for oil and its chemical conversion into industrial chemicals competitive with synthetic products for resins, protective coatings, elastomers, and lubricants | 5,000,000 |
| 9. Expansion of research on the development of stable instant dried whole milk, and of low-fat dried milk, that can be readily reconstituted to beverage milk of excellent palatability and high nutritive value | 2,600,000 |
| 10. Development of methods of raising disease-free poultry which could be processed for extensive export markets and which would provide for utilization of surplus grains as feed | 2,000,000 |

*Research proposals worthy of consideration in the event a crash program is to be undertaken to help dispose of agricultural surpluses*—Continued

| | Amount |
|---|---|
| 11. Development of potential new farm crops for drug or specialty purposes, such as production of vegetable tannin, low-cost rotenone, cortisone-type drugs and hormones, wax for chewing gum, wax and polish industries, and analgesic and circulatory drugs | $2,000,000 |
| 12. Research to expand the markets for hides and leathers by development of (1) lower cost tanning processes; (2) washable leathers for use in garments; and (3) leathers with improved resistance to wear and with qualities suitable for new uses | 800,000 |
| 13. Improvement of methods for meat tenderization, based on expanded studies of the basic physics and chemistry of meat and the engineering development of new techniques, in order to increase the utilization of lower grades of beef | 2,000,000 |
| 14. Reduction in processing cost of animal products through the development of rapid, semicontinuous, mechanochemical manufacturing methods | 5,000,000 |
| 15. Reduction of the cost of rice and rice products by developing more efficient methods for drying, milling, and processing rice, by lowering the cost of manufacturing rice products, and by increasing the return from low-quality rice and byproducts, in order to improve the position of domestic rice in world markets | 1,000,000 |
| 16. Determination of the composition of corn, wheat, sorghum, and other small grains and the properties of the constituents to provide the necessary basis for development of the most efficient utilization and improved processing of these grains for industrial and feed uses | 2,000,000 |
| 17. Incorporation of wheat grain and wheat flour as binder and filler in hardboard and boxboard utilizing the adhesive properties of both grain and grain products as found or improved by chemical modification | 1,000,000 |
| 18. Production and development of high-amylose corn as a replacement crop for common corn through research on processing methods for the separation of starch from high-amylose corn and development and evaluation of the starch for industrial uses | 500,000 |
| 19. Increased research on wheat to expand demand for wheat food products, through development of processes and products that will provide consumers with attractive, flavorful, convenient, and nutritious products at lower cost | 1,500,000 |
| 20. Expansion of domestic and export consumption of fruits and vegetables, and of acreage devoted to these crops, by overcoming extreme perishability and high distribution costs through new and improved processing methods; and developing preservation methods for new fruit and vegetable crops not now widely grown in the United States | 2,000,000 |
| 21. Development of poultry and egg products of high quality, great convenience of use, and low cost, thus expanding the demand for and production of poultry, and greatly increasing the utilization of surplus grains | 2,000,000 |
| Total | 47,500,000 |

SELECTED EXAMPLES

1. *Title.*—Production of higher quality protein supplements by fermenting cereal grains to produce microbial protein concentrates having high content of the essential amino acids, and development of low-cost processes for making highly desirable feedstuffs from barley.

*Estimated annual cost.*—$2,300,000.

*Problem, need, and value.*—(1) Fermentation of cereal grains for higher quality products: Research is required to find microorganisms capable of converting the starch content of grain into protein concentrate high in the essential amino acids—lysine, tryptophane, and methionine—to bring animal rations into more

efficient amino acid balance. The protein concentrates made should have 20 percent, or more, of their content in the form of these acids.

Livestock require supplements to make up amino acid deficiencies in grain. The industry would require about 150,000 tons of the amino acids, the production of which would use 150 million bushels of grain. The fermentation proteins would make available needed supplements now obtained mainly from soybean meal and thereby greatly increase the efficiency of grain feed for all livestock. This contribution would (*a*) improve feed efficiency of livestock production about 10 percent, and (*b*) make available additional soybeans for export, the foreign outlets for which have promise. Some subsidy might be required.

(2) Low-cost processes for making highly desirable feedstuffs from barley: Research is needed to develop low-cost ways of removing the fibrous material of the barley husk and of preserving as nearly as possible the protein fraction between the outer husk and the kernel. The high fiber content of the husk limits its use by swine and poultry and requires grinding, milling, or soaking before feeding. Barley tends to produce the much desired leaner meat-type animal. However, it cannot be readily utilized by farmers despite the real price advantage it has as a locally grown high-carbohydrate feedstuff in sections where corn is not grown.

On January 1, 1956, the Commodity Credit Corporation owned over 30 million bushels of barley with an additional quantity under loan. A 10-percent increase in consumption of barley would remove about 40 million bushels annually from the market, thus relieving the present surplus problem.

2. *Title.*—Incorporation of starch into paper and paper products as an extender to meet the Nation's expanding pulp requirements.

*Estimated annual cost.*—$3 million.

*Problem, need, and value.*—Research is needed (1) to develop modified starch to serve as an extender of pulp and to improve paper production methods so that increased amounts of starch can be used in sizing and coating of paper to extend pulp supplies, and (2) to produce starch in a form that would replace pulp in part by making starch in fibrous form or having it combine chemically as an integral part of the pulp.

Introduction of starch in amounts of but 2 to 5 percent of the 30 million tons of pulp and paper products used in the United States would require from 40 to 100 million bushels of grain for the starch used. Through large-volume production, starch prices should be low enough to compete with wood pulp at $125 to $150 per ton. The major byproducts of starch production would be oil and protein from corn, and protein from wheat—each of which could be disposed of either on the domestic market or abroad. No subsidy is expected to be necessary on part of the uses. In other cases, dependent upon the quality imparted by the starch replacement, small subsidies might be necessary.

3. *Title.*—Increased industrial consumption of starch from cereal grains by conversion to oxystarch for production of new industrial products, chemical intermediates, and superior modified starches.

*Estimated annual cost.*—$2 million.

*Problem, need, and value.*—Research is required to exploit fully the uses of periodate oxidized starch, a starch product now of high potential value because of the recent discovery of an inexpensive production method. Research is also needed to develop large-scale production methods for this new product, for its evaluation as a coating and sizing for textiles and paper, as a tanning agent for leather, as a component of plastics, and to develop polyhydric alcohols, new polymers, and other special industrial products from periodate oxidized starch as a starting material. This new product could consume starch from approximately 10 million bushels of grain each year by replacing (*a*) 25 percent of the 120,000 tons of imported vegetable tannins valued at 25 to 50 cents a pound; (*b*) 10 percent of the billion pounds polyhydric alcohols derived largely from petroleum sources and valued at 30 cents per pound; and (*c*) 10 percent of the cellulosic, phenolic, and urea-melamine plastics priced at 30 cents per pound; and by extended use of starch in the textile and paper fields. Subsidy would be required in the polyhydric alcohol field unless highly efficient conversion processes could be developed.

4. *Title.*—Production of natural and synthetic rubbers from grains by fermentation and various chemical processing methods

*Estimated annual cost.*—$2,500,000.

*Problem, need, and value.*—Conversion of grain to natural or synthetic-type rubber offers one of the largest potential outlets for surplus grain. The United States imports some 600,000 tons of natural rubber and manufactures over

700,000 tons of elastomers from petroleum products. This total tonnage if produced from grain would be equivalent to between 250 million and 300 million bushels. Three methods are known for production of synthetic rubber from grain: (1) Fermentation to ethyl alcohol or butylene glycol and conversion to GRS rubber; (2) fermentation to itaconic, aconitic, or fumaric acid which can be copolymerized with butadiene to give mixed polyester rubbers similar to GRS rubber but having qualities fitting them for special uses; and (3) direct fermentation to natural-type rubber by fungi, such as the genus *Lactarius*.

Method (1) has been extensively used and is either marginal or would require subsidy. Methods (2) and (3) are new approaches which could be economical if they yield a maximum of 7 to 8 pounds of rubber per bushel of grain, and if rubber continues to sell at 30 to 35 cents per pound. Developmental research would be carried out on fermentation acids under method (2), which may be specially useful since these intermediate substances cannot now be maintained from petroleum products. Since development of method (3) could possibly revolutionize rubber production, this phase warrants most attention.

5. *Title.*—Development and testing of methods of production of Choice lambs at weaning in Southeastern States to utilize surplus crop acreage.

*Estimated annual cost.*—$2 million.

*Problem, need, and value.*—Reliable methods need to be developed for the production of Choice weaner lambs in the Southeastern States as a source of supplementary income and through use of pasture and forage to replace a portion of the crop acreage now used for cotton, tobacco, and other cash crops presently surplus to current needs. Research must necessarily include (1) disease and parasite studies; (2) research to determine breeds or breed combinations best suited to the area; environmental studies including the use of hormones to induce summer breeding and a high rate of conception at any season; feeding and nutrition research, including especially the utilization and nutritive value of grasses and legumes adapted to the area and productive, in proper succession, throughout the year; and (3) research on supplements, especially locally produced byproduct feed supplements, including peanuts, cowpeas, and cottonseed meals, required for the efficient utilization of weather-damaged and other low-quality forages, both harvested and in the field.

The 12 Southeastern States contain more than 2 million farms. Most of these farms are small, with an average area of less than 120 acres, and with an average of about 25 acres of crops harvested. These States raise about 11 million acres of cotton and more than 1.5 million acres of tobacco. Restriction of cotton and tobacco acreage poses a very serious problem for the small farmer in finding crops which will produce supplementary income, especially in the livestock field. The production of choice weaner lambs offers such an opportunity. The area is well suited to the production of year-round pasture and forage.

The national average consumption of lamb is about 4.5 pounds per capita; that of the 12 Southeastern States, only about 0.7 pound. About 3.5 million lambs would be required to raise consumption of lamb in these 12 Southeastern States to the national average. Such an increase would represent only about 0.75 pound per person on a national basis. The national average consumption of lamb fell from 7.2 pounds per capita in 1945 to 4.5 in 1954.

The 3.5 million additional lambs proposed could be produced on about 1 million acres of the present cropland devoted to cotton and tobacco in these 12 States through the development of highly improved pastures. Gross income from the proposed 3.5 million lambs and the wool from the ewes would amount to about $70 million and net farm income to about $35 million.

6. *Title.*—Research on cotton and wool to develop (1) radically new machinery and methods for efficient conversion of cotton lint into new and improved fabrics for new specific end uses and markets; (2) new instruments for measuring physical properties of cotton fibers, yarns, and fabrics; (3) chemical treatments which will increase the desirable qualities of cotton products; (4) new textile and nontextile uses for cotton lint including improved nonwoven cotton fabrics and improved cotton-reinforced plastic laminates; and (5) expanded markets for wool by improvement of wool qualtities through chemical modification; new wool products with enhanced attractiveness and diverse uses, and more efficient manufacturing processes.

*Estimated annual cost.*—$5 million.

*Problem, need, and value.*—(1) Cotton, a versatile fiber, once met most textile needs, but is now meeting ever-increasing competition from synthetic fibers. During the past 20 years synthetic fiber production in this country has increased

from 262 million to 1,718 million pounds, an increase equivalent to more than 3½ million bales of cotton. A greatly increased research program on cotton is vital in order to compete with synthetic fibers. It is believed that cotton could reclaim or gain substantial amounts of the present and future fiber market because of its superiority in particular properties.

Reduction in the cost of cotton lint and savings in manufacturing costs are essential to meet competition. These could be effected (1) by development of radically different equipment for effectively cleaning mechanically harvested and other low-grade cottons without loss of spinnable fiber, for cheaply and efficiently spinning cotton, including the very short staples and for high-speed warp knitting of cotton; and (2) by development of rapid and accurate instruments for measuring the physical properties of cotton fibers and fabrics in order to produce new and improved cotton products, thereby increasing consumer acceptance. New Methods and new chemical processes must be found to impart additional desirable properties to cotton. New textile and nontextile uses for cotton lint, including improved nonwoven fabrics and improved cotton reinforced plastic laminates, are needed. The potential market for nonwoven cotton fabrics is large and there is a large volume potential market for cotton as filler material in the production of low-pressure polyester plastics.

(2) Wool production has fallen from a prewar average of 365 to less than 230 million pounds (grease basis). It is not a domestic surplus commodity as we import almost two-thirds of our current requirements. However, to replace 20 percent of current imports (the initial goal of the National Wool Act of 1954 which is designed to increase domestic production) at least 9 million acres of good grazing land would be needed and could be developed from lands now producing surplus grains. Steadily rising costs of production and processing have contributed to the decline in the domestic crop of shorn wool. Domestic markets could be recaptured through research which would lead to efficient manufacture of new wool products with enhanced attractiveness and more diverse uses.

7. *Title.*—Development of industrially practicable processes for pulping and use of fibrous plants as replacement crops for grains to extend our domestic sources of newsprint and other paper products, cordage, dissolving pulp for fiber and film manufacture, and building board.

*Estimated annual cost.*—$1,300,000.

*Problem, need, and value.*—Research is required to develop technical information on processes, products, and potential of fibrous crops, such as timber bamboo, hemp, kenaf, flax, sweetclover, and sericea lespedeza, which can be grown in grain-producing areas, as a source of pulp for newsprint and other paper products. Such fibrous crops would supplement domestic and imported woodpulp for which there is tremendous need. As an example of the need for pulp, the total consumption of paper products in the United States is over 32 million tons. There is also good opportunity for growing crops of special value for cordage and dissolving pulps but although such crops would provide best monetary return, their market potential is relatively small and would not require large acreages for their cultivation.

If fibrous crops could capture 10 percent of the paper market, 3 million tons of pulp would be required, or approximately 7 million tons of fibrous crops. Based on production of fibrous crops of between 2 and 6 tons per acre, 1 to 3.5 million acres of wheatland would be required. Considering $14 per ton now paid for straw going into corrugated paper as a minimum return, the problem lies in getting a fibrous crop that can be processed for commercial use and that will produce enough tons per acre to make it profitable for the farmer to grow.

8. *Title.*—Production and processing of safflower, flaxseed, and other crops for oil and its chemical conversion into industrial chemicals competitive with synthetic products for resins, protective coatings, elastomers, and lubricants.

*Estimated annual cost.*—$5 million.

*Problem, need, and value.*—About 5.5 billion pounds of synthetic organic chemicals are consumed annually in this country. To supply 5 to 10 percent of this potential market with chemical derivatives made from safflower, flaxseed, castor beans, or other oilseed crops would result in the replacement of 1 to 4 million acres of grain. Research in both production and utilization of oilseed crops would be required as follows:

Safflower is currently grown on 75,000 acres. Production could be expanded to 1 million acres as a replacement crop, but would require development of improved varieties with local adaptations and multiple-disease resistance. If the price of safflower seed were maintained at present levels, $76 to $84 per

ton delivered, as an inducement to farmers and some additional milling facilities, provided it appears unlikely that other incentives would be required.

Flax: At present there is a surplus of linseed oil. Increased demand for it is dependent largely on development of chemical means of modifying it. Existing varieties of flax should be surveyed to determine the best varieties available for use, adapting them as necessary to the processing techniques evolved in utilization research, and increasing such seed and making it available to farmers.

Castor bean production could be expanded as a replacement for cotton on about 400,000 acres in Oklahoma, Texas, Arkansas, Missouri, and Mississippi and the irrigated valleys of New Mexico, Arizona, and California. Continued research would be needed to develop improved disease-resistant varieties, but the principal production need is for harvesting machinery in order to expand production. A pilot-model harvester has been developed and tested for dryland farming of the high-plains area for plants up to 6 feet tall and yields up to 1,200 pounds per acre. However, the harvester must be adapted to the higher yielding varieties of the irrigated areas and to the humid region. It would be necessary to develop suitable production harvesters through a negotiated contract with a reliable manufacturer.

Utilization: The oils of safflower, flax, and castor beans are chemically capable of a wide variety of modification reactions, and are accordingly especially promising as raw material for plastics, plasticizers, lubricants, films, and other end products of the multi-billion-pound chemical industry. Castor oil has long since demonstrated its versatility in such uses. Intensive chemical research can extend these widely and develop new chemical outlets also for safflower and linseed oils. Efficient processing methods for safflower, flaxseed, castor beans, and other oilseed crops need to be developed to give highest yields of oil and to produce residual meal of best nutritive value for feed use. Castor meal can be used as fertilizer but not as an animal feed or in preparation of industrial products unless a nontoxic and allergen-free meal can be developed.

9. *Title.*—Expansion of research on the development of stable instant dried whole milk, and of low-fat dried milk, that can be readily reconstituted to beverage milk of excellent palatability and high nutritive value.

*Estimated annual cost.*—$2,600,000.

*Problem, need, and value.*—Dried whole milk develops undesirable flavors and decreased dispersibility during storage, primarily because of oxidation or hydrolysis of its constituent fats and changes in the milk proteins. Current studies have produced an experimental product of high quality and ready dispersibility when reconstituted within a short time after drying, but an intensive attack on means of preserving the flavor and physical properties is urgently needed. Solution of this problem is a prerequisite to increased consumption of milk reconstituted from dried whole milk.

Low-fat (10 to 14 percent) dried milk offers a partial solution to the problem, since it has better keeping quality and dispersibility than dried whole milk (26 percent fat). One pound of this product would reconstitute to produce 7 pounds of fluid milk containing 2 percent fat and 11.5 percent nonfat solids. A milk of this composition has a full flavor and excellent nutritional value, due to its high content of protein. This product has interesting possibilities as a new outlet for surplus milk; however, there would be certain problems having to do largely with changes in dispersibility during storage.

It is estimated that development of a stable dried whole milk could increase the consumption of milk by 2 ounces per capita per day. This is equivalent to 7.3 billion pounds of milk annually, with a value to the farmer of $227 million, based on a value of $3 per hundredweight for manufacturing milk. Similarly, consumption of low-fat dried milk could provide an outlet for an additional 6.4 billion pounds of fluid milk, corresponding to a per capita consumption of 1.8 ounces daily and having a value to the farmer of $192 million.

10. *Title.*—Development of method of raising disease-free poultry which could be processed for extensive export markets and which would provide for utilization of surplus grains as feed.

*Estimated annual cost.*—$2 million.

*Problem, need, and value.*—It is estimated that a potential export market for 200 million pounds of poultry, on a ready-to-cook basis, exists in European and South American countries. This estimate is based on exports of an average of 1 pound of poultry per capita per year. Based on a conversion factor of 4 pounds of grain to produce a pound of poultry meat, this potential market could utilize over 13 million bushels of wheat equivalent per year. The possibility of our exporting to these countries has been materially enhanced by the enactment of

Public Law 480. There remains, however, the problem of establishing assurance to importing countries that poultry diseases will not be imported with the product.

In the United Kingdom, for example, with a potential market of 75 million pounds, their poultry-disease-control programs prohibit the importation of poultry meat from areas not free of Newcastle disease. It has been determined by informal conversations that development of a Newcastle-disease-free area in this country from which poultry could be exported would lead to consideration of the purchase of United States poultry meat by the United Kingdom.

Research is required to demonstrate whether such a Newcastle-disease-free area can be established. Other diseases should be included, because there is no assurance that barriers similar to the one against Newcastle disease would not be invoked on chronic respiratory disease and the Salmonella infections.

It would be necessary to select an area with natural or other boundaries which would make quarantine feasible and effective and with sufficient poultry production to supply sizable quantities for export. The area selected would also require full cooperation of the poultry industry and of State livestock sanitary officials, as well as their participation to the fullest possible extent. Maine and New Hampshire or North and South Carolina are potential areas for such trials.

Within the quarantine area it would be necessary to prevent any poultry and poultry products moving into that area and to vaccinate all poultry with killed Newcastle-disease virus vaccine. As that disease is eliminated, the requirements for vaccination would decrease from year to year. It would also be necessary to identify breeding flocks free of chronic respiratory disease and to replace all infected flocks with disease-free stocks after disinfection of premises and to identify and eliminate all birds harboring Salmonella infections.

11. *Title.*—Development of potential new farm crops for drug or specialty purposes, such as production of vegetable tannin, low-cost rotenone, cortisone-type drugs and hormones, wax for chewing gum, wax and polish industries, and analgesic and circulatory drugs.

*Estimated annual cost.*—$2 million.

*Problem, need, and value.*—In order to realize the most immediate benefits from potential new crops to help promote a more diversified, stable, and profitable agricultural industry, and provide crops to replace those now in surplus, there is need to place under preliminary trial production a limited group of plants which have shown the highest potentiality of becoming new crops.

(1) Vegetable tannin: Canaigre is a potential new farm crop which could occupy approximately 100,000 acres in the irrigated valleys of southern Arizona and southern Texas for the production of vegetable tannin. In addition to use as a tanning agent for leather, canaigre offers potentialities for utilization as an effective compound for boilers and in the oil-well-drilling processes. Increased canaigre production would require an increase in suitable planting stock, improved production and harvesting equipment, and the industrial development of processing plants to make the tannin extract.

(2) Low-cost rotenone: *Tophrosia vogelii*, a leguminous plant, has shown much promise in the marginal cotton and peanut areas in southern United States as a potential new and low-cost rotenone-producing crop. Rotenone is valuable because it creates no hazard to public health when applied to an agricultural crop. The estimated crop-production potential is 30,000 to 50,000 acres. Seed production would need to be increased in Puerto Rico by the Federal experiment station there (it does not seed in the United States); sufficient seed for planting 30,000 to 50,000 acres probably could be available by 1958. Additional research information is needed relative to effective production practices.

(3) Cortisone-type drugs and hormones, used in treatment of arthritis, are made from the chemical Diosgenin found in the tubers of the plant Dioscorea (yam). Potentially, the crop could occupy approximately 25,000 acres of the cotton and peanut areas in the lower southern United States. Propagation of the best lines of the plant is necessary in order that commercial nurserymen can build up stock.

(4) Wax for chewing gum, wax, and polish industries: Candelilla, a wax-producing shrub, could occupy approximately 50,000 acres of cropland in the Southwest. This plant takes from 2 to 5 years to mature for wax harvest. Seed and rootstock material would need to be selected, the seed propagated, and cultural studies made.

(5) Analgesic and circulatory drugs: Roots of a small shrub, Rauvolfia, are the source of these drugs. This plant could occupy approximately 10,000 acres

now devoted to cotton and peanuts on the gulf coast area, excluding Florida. It takes from 3 to 4 years to mature for harvest. Seed would need to be collected and research conducted on cultural practices and adaptability.

12. *Title.*—Research to expand the markets for hides and leathers by development of (1) lower cost tanning processes, (2) washable leathers for use in garments, and (3) leathers with improved resistance to wear and with qualities suitable for new uses.

*Estimated annual cost.*—$800,000.

*Problem, need, and value.*—Recent record livestock numbers and increased slaughter have resulted in an excess of 6 million hides annually over domestic needs. The situation is further aggravated by competition from plastics and substitutes for traditional uses of leather.

This is especially serious in the field of shoe manufacture, which once accounted for 85 percent of our domestic leather use. Cheaper synthetic sole materials have replaced over 60 percent of heavy leather requirements for shoe manufacture, while nylon and mylar plastics are making serious inroads into the upper-leather market.

The tanning industry is greatly in need of a more economical and rapid process for production of sole leather, based on cheaper tanning and improved leather which could compete more successfully with leather substitutes. A more rapid and cheaper tanning process could result in increased utilization of about 2 million hides annually.

New and broader uses of leather are also imperative. Development of leather with improved resistance to wear, deterioration from polluted atmospheres, and with increased dimensional stability would broaden the utilization of leather as a decorative material for floor tiles and wall coverings, and utilize about 500,000 hides per year.

Development of light leathers combining the fine qualities of our present leather with improved workability and ease of care would broaden utilization of leather in the manufacture of clothing and personal articles with increased utilization of about 5 million hides annually.

13. *Title.*—Improvement of methods for meat tenderization, based on expanded studies of the basic physics and chemistry of meat and the engineering development of new techniques, in order to increase the utilization of lower grades of beef.

*Estimated annual cost.*—$2 million.

*Problem, need, and value.*—Much of our current beef supply is discriminated against in the market because it is lacking in tenderness. This is the result of many factors, including the poor finish of grass-fed steers, the large surplus of cows, and lack of tenderness of the less desirable cuts of beef of all classes. Agricultural trends indicate that this condition will become more, rather than less, pronounced.

An expansion of the currently projected program of basic studies of meat physics, chemistry, and biology is needed to permit rapid development of new techniques for meat processing that will result in more tender beef. Such factors as protein structure, protein chemistry, relationship of these to tensile and shear strength, histochemistry of meat, and microbiological control should be thoroughly investigated. In addition, engineering studies should be employed to translate basic knowledge into processing methods.

If currently marketed lower-grade meats were improved through development of methods for meat tenderization, it could be expected to bring such beef into market channels at a price of at least 3 cents a pound higher than at present, with an accompanying return of $1.8 billion annually.

14. *Title.*—Reduction in processing cost of animal products through the development of rapid, semicontinuous, mechanochemical manufacturing methods.

*Estimated annual cost.*—$5 million.

*Problem, need, and value.*—The increasing modern demand is for foods of highest quality and greatest convenience in preparation for the table. If old and new animal products of this kind can be had together with reduced processing costs increased consumption will result. Per capita use of pork products in recent times has declined appreciably. Improved ham and bacon products would contribute to reversal of the trend. Better sausage products and precooked dishes would increase demand for cow beef which constitutes 40 percent of our supply. The problem of toughness in frozen poultry is one of major importance to the industry. Costs of cheese production can be reduced by a cent per pound with concomitant improvement in quality and increase of consumption. Improvement in texture and flavor of butter would result in increased

sales. Flavored milk products in stable dehydrated form would provide popular new and wholesome beverages. The whole sequence of packinghouse operations should be studied intensively to improve quality and reduce cost at many points.

At least 4 pounds of grain are required to produce a pound of meat, and dairy products require a proportionately large intake of feed. Increase in use of meat and dairy foods accordingly contributes not only to alleviation of animal product surpluses but to effective utilization of grains also.

This project would be designed to develop new and attractive animal products and to improve quality and reduce costs throughout the industry.

15. *Title.*—Reduction of the cost of rice and rice products by developing more efficient methods for drying, milling, and processing rice, by lowering the cost of manufacturing rice products, and by increasing the return from low-quality rice and byproducts, in order to improve the position of domestic rice in world markets.

*Estimated annual cost.*—$1 million.

*Problem, need, and value.*—Loss of offshore markets, caused by our inability to offer rice at a sufficiently attractive price, is primarily responsible for the present carryover of rice in this country, which has rapidly risen during the past 2 years to approximately 14 million bags, the equivalent of 25 percent of our present annual production. Immediate remedial steps must be taken to recapture and stabilize our offshore outlets for rice, or else some of these markets will be permanently lost.

Cheaper ways must be found for drying, milling, and other processing of rice in order to hold or expand our sales outlets in foreign markets. Our processed rice products need to be further modified to meet the taste and price limitations of offshore consumers. Processing methods now practiced are generally inefficient, resulting in a high direct cost, and an excessive amount of waste and byproducts for which only limited and generally uneconomic uses are known.

Evaluation of basic findings through extensive pilot plant and conclusive commercial adaptation work, costs of drying, milling, and processing rice can be reduced and quality improved. This would assure continuation of our past export business (about 25 percent of the total world trade) and should result in substantial increases. A surplus commodity would thus be eliminated without reducing the current rice acreage (1.8 million), and at the same time the return to growers and processors would be increased.

16. *Title.*—Determination of the composition of corn, wheat, sorghum, and other small grains and the properties of the constituents to provide the necessary basis for development of the most efficient utilization and improved processing of these grains for industrial and feed uses.

*Estimated annual cost.*—$2 million.

*Problem, need, and value.*—Increased industrial utilization of starch and protein is a major point of attack on the present surplus of wheat and corn. To provide the information required for the development of new and economical industrial uses for these major components, intensified research is required to elucidate fully their detailed composition, structure, and physical and chemical properties. Unique properties of these constituents will thereby be recognized which will enable their utilization in end products which make maximum use of these specific characteristics.

Processing of these major constituents leaves the problem of most economical disposal of the byproducts, made up essentially of the minor constituents of the grain. Attention must be given to composition factors which will enable their most efficient use in feeds and feed supplements. While feed use could probably utilize all of such byproducts, more remunerative outlets would be highly desirable. Hence, study would also be made of the chemical properties and transformation of the minor grain constituents which would appear in the byproducts, with the objective of converting them to forms having greater industrial utility and value.

17. *Title.*—Incorporation of wheat grain and wheat flour in hardboard and boxboard as binder and filler utilizing the adhesive properties of both grain and grain products as found or improved by chemical modification.

*Estimated annual cost.*—$1 million.

*Problem, need, and value.*—Production of hardboard and boxboard in this country requires more than 6 million tons of wood and wood products annually. Potentially, wheat flour or grain might be incorporated in these products to serve as a binder or as a structural element. Developmental research is required to determine the chemical or physical modifications needed for optimal prop-

erties of grain or flour in these applications. As a binder in hardboards, unmodified wheat flour at 6 cents per pound would be in competition with synthetic resins at 20 to 40 cents per pound. Replacement of 1 to 5 percent of the weight of these products by wheat or wheat flour would provide a market for about 4 to 20 million bushels of wheat.

Limited experimental work already has indicated that wheat in expanded [puffed] form has special value for use in producing a resin-bonded board which may be competitive with presently marketed coreboard now used in the manufacture of furniture, doors, floors, partitions, and the like. This market alone, if completely captured, would consume approximately 15 to 20 million bushels of wheat.

18. *Title.*—Production and development of high-amylose corn as a replacement crop for common corn through research on processing methods for the separation of starch from high-amylose corn and development and evaluation of the starch for industrial uses.

*Estimated annual cost.*—$500,000.

*Problem, need, and value.*—Corn, which contains a high percentage of an unusual type of starch, called amylose starch, shows promise as a new and unique industrial raw material for conversion into films and fibers or for other purposes. Research is needed to develop starch-processing methods and to carry out industrial evaluation of the starch for the production of self-supporting films, fibers, detergent assistants, plastics, superior drilling-mud additives, and special industrial products; also to increase through breeding research the amylose content of high-amylose corn from the present figure of 70 percent up to 80 percent or better, to fit it for a wider range of utility.

High-amylose starch would be generally competitive with dissolving pulp now made from pulpwood. The most promising and perhaps largest potential outlet would be the production of edible films for which there is a large demand in the packaging of food products not now met by any known material. In 1954, 775,000 tons of dissolving wood pulp was produced, selling at from $185 to $225 per ton. Sales of high-amylose starch are expected to reach 20 percent of this figure. This would require 10 million bushels of corn produced on 250,000 acres. It would be wholly used for industrial purposes and, like the waxy corn Tapicorn now grown, which pays the farmer a 12 percent premium over common corn, would bring greater than normal income to the farmer.

Mr. HARVEY. I have not had an opportunity to study this, Dr. Hilbert, so I am certainly not going to be prepared to question you concerning the details, but I do want to say I appreciate very much the introduction of this legislation and the concern and interest all the country has in this program has caused you to come up with these so-called "crash" programs which in your judgment are the best and most lucrative fields you think could be explored in the future.

Mr. DIXON. I am most interested in this. I would like to sit down with you for a week, Dr. Hilbert. This is surely intriguing, and it bears out your original thesis in your talk, Mr. Harvey, of the opportunity for a permanent solution to agriculture through research.

I am glad, Representative Harvey, you are having this material inserted in the record. I might say to Dr. Clarkson I have a feeling his outlined administration of the problem would be a preferential one, though I recall Representative Harvey said he had no particular brief for any administrative setup, although he did prefer to some extent a separate administration and organization.

Mr. HARVEY. Yes; I think I made it clear in my statement that primarily it was one of emphasis, Dr. Dixon. It was my feeling because of budgetary reasons, and knowing the attitude of the fiscal officers of the Government, I did not have too much hope the right emphasis could be given to the problem as long as it continued to be a part of the Department. I had no other prejudices. If the Congress, as I state in my statement, felt in its wisdom it should be car-

ried out by being a part of the Department of Agriculture, certainly I would not let my objection keep that from being carried out.

Mr. DIXON. I notice in one bit of legislation that I introduced our committee was very firm in its statement that it wanted 25 percent of the fund allocated to research in marketing, and research on the new uses of farm products. So from that I would infer that your committee is firm in its stand to divert, or place more emphasis upon marketing and upon new uses of agricultural commodities.

Representative Harvey's fear is if this program is left to you, you will still continue to let research for production steal the show. What is your reaction to that?

Dr. CLARKSON. I think that we may state very emphatically that production research would not be allowed to suffer by the Department of Agriculture; that the needs for improving the farmers' ability to produce goods economically, to fight insects, and diseases, and conserve the soil will still command attention.

However, there is no question but with the passage of this legislation the Department of Agriculture would bend its every effort toward the fullest realization of the work that is provided for in this legislation. I cannot emphasize that too strongly because I feel that sincerely, and I am sure the Department and the Administration would do so.

Mr. DIXON. What are the forces that have caused research to go so largely in the direction of production and to such a small extent in the direction of marketing and extended use of agricultural commodities?

Dr. CLARKSON. Part of it is historical and part is in response to day-to-day problems. Historically, the four regional laboratories were established in the late 1930's to deal with this very problem. They had just become established and begun their work when the war came upon us. During the periods following the war the emphasis was on efficient production to supply ourselves and our allies throughout the world for quite a number of years.

In 1946, with the passage of the Research and Marketing Act, interest and emphasis were on marketing particularly, but upon utilization also. Since that time our research efforts and service efforts of the Department in marketing have very much increased, and they have increased to a lesser proportion on utilization.

Mr. DIXON. Would you say there is an unwarranted social lag in both those directions?

Dr. CLARKSON. I think that that is a correct way of stating it. Along with that is the day-to-day problem of the farmers, of agricultural colleges, of farm organizations, of legislatures, and administrators of meeting the very urgent problem of devastation of diseases, devastation of insects, loss of soil, loss of productivity through many causes, and the adjustments, or need for adjustments, of the farmers' ability to produce economically in a world of rising costs to them and more or less stable return.

Those problems are very real; they are very urgent, and they are constantly before everyone, the Department and the Congress along with others.

Mr. DIXON. We cannot engender the same nationwide enthusiasm for this as we can for high support prices, is that not right, or do you think it is possible to do it?

Dr. CLARKSON. I think enthusiasm can be engendered for this, and I think latently there is that enthusiasm in the minds of those who know the agricultural problem, but as the day-to-day efforts are made on agriculture this is one that looks perhaps a little more to the future than the emergent problem of dealing with a disease which is devastating the field or the orchard.

Mr. DIXON. Do you think if you had this money to administer you could really champion the cause so other forms of research would not steal the show from us again?

Dr. CLARKSON. Yes.

Mr. ABERNETHY. Dr. Dixon just asked what were the forces that had pressed us into lending extraordinary emphasis to production. Would you say one of the answers is the following: in the discussions that we have had over the past 7, 8, 9, 10 years, or even longer, it has been suggested time and time again that many of our farms were inefficient. By inefficient they meant they were not getting the best production therefrom. So we have, in our efforts to make these people efficient—and some of them have been made efficient—it has resulted in aggravating the surplus problem, is that not true?

Dr. CLARKSON. We have given a great deal of attention to increasing the efficiency of the production process. During these last 2 or 3 years, we have put every effort we know in our research program into lines of research that will reduce the devastation of diseases and pests; that will conserve the soil and that will improve the opportunities for expansion of our animal agriculture.

Mr. ABERNETHY. I want to ask you this question about the bill that you have submitted: Is it more or less an amendment to the Hope-Flannagan Act, and to be administered by the same agency of the Department?

Dr. CLARKSON. The Hope-Flannagan Act emphasizes the marketing aspect of the work that is handled in the Department of Agriculture by the Agricultural Marketing Service. The utilization research that is authorized by the Hope-Flannagan Act, and other acts is conducted, and this work would be conducted, under the revised bill, primarily through the Agricultural Research Service.

Mr. ABERNETHY. I have just read through the bill that you submitted with your statement. I do not know whether it is due to my inability to absorb in a short length of time or whether the bill really does not say very much, but what does this bill do in addition to the authority we already have in the field of research? What does it propose to do?

Dr. CLARKSON. One of the things that it does, as Representative Harvey suggested, it emphasizes the need for utilization research. Secondly, it gives a broader authority to the Secretary of Agriculture for the accomplishment of this research through facilities not under the control of the Secretary of Agriculture.

Mr. ABERNETHY. Let me interrupt you, and I hesitate to do so. Do you not already have considerable authority in the Research Act of 1946 for utilization research?

Dr. CLARKSON. Yes.

Mr. ABERNETHY. Is the question one of money?

Dr. CLARKSON. Not entirely. In order to do the size job envisioned here, additional authority would be necessary to be able to make grants

as well as contracts to experiment stations of the States, universities, and nonprofit research institutions.

Mr. ABERNETHY. Let me interrupt again. What authority is now lacking to enable you to make those contracts? What kind of contracts do you have reference to?

Dr. CLARKSON. We have authority now to make contracts. We have no authority to make grants, and contracts are not always feasible when dealing with nonprofit research institutions. This requested authority would make grants.

Mr. ABERNETHY. What would be the difference between a grant and a contract? Even with a contract you have to finance it.

Dr. CLARKSON. Yes. Under the contracting authority and contracting practices of the Department, a sum of money is paid for a precisely determined research job. All of the patent rights accrue to the people through the Secretary of Agriculture.

In a grant, especially for fundamental research, we can work out an arrangement with a nonprofit research institution to have research work done which does not call for the retention of patent rights to the Government. It allows them to activate this research in conjunction with their own research and allows us the opportunity to have this kind of work done with institutions which do not favorably go into contract work.

There are some institutions that will not go into contracts with us because of the limitations of rights that accrue to the Secretary.

Mr. ABERNETHY. Well, Mr. Harvey's bill makes some provisions for plans and facilities, and the purchase of equipment and so on. Does the department feel a need for anything of that character in expanding a research program in the method outlined in the bill that you have submitted?

Dr. CLARKSON. We think, and we have provided in what we have presented, we do need additional authority in the acquisition of property and have provided for its acquisition by lease, loan, or gift in addition to construction which we normally have authority for.

Mr. ABERNETHY. This is maybe not too important. In section 5, I note the following language:

> In carrying out the provisions of this Act the Secretary is authorized to obtain the services of experts and consultants in accordance with the provisions of section 15 of the Act of August 2, 1946, as amended, at rates not to exceed $100 per diem * * *.

Now, that is pretty liberal, is it not?

Dr. CLARKSON. Well, my own personal viewpoint is it is liberal, but in order to get the services of the experts in this field who are currently employed and busy with universities, or other institutions, we believe it is necessary to have authority to go that high. This is their fair compensation.

Mr. ABERNETHY. Is it contemplated that these people will be employed on a daily basis, or part-time basis?

Dr. CLARKSON. This would be on a daily basis for a period of a few days at a time. We have authority to appoint consultants. This expands that authority and sets the $100 limitation and would allow us to pay the traveling expenses of such consultants.

Mr. ABERNETHY. Would you tell the committee whether or not the Department feels a great need for the legislation as embodied in the bill which accompanied your statement?

Dr. CLARKSON. The Department favors the passage of this bill as amended by the amendment I presented to you.

Mr. ABERNETHY. Are we to understand that the Department is requesting the passage of this bill?

Dr. CLARKSON. Yes.

Mr. DIXON. I just want to ask Dr. Clarkson, you refer to this as an amendment. Is this an amendment to the Harvey bill, or is it a complete bill?

Dr. CLARKSON. It is an amended bill, or a revised bill. This is a complete revision of the bill.

Mr. DIXON. In other words, the entire problem is covered in this statement?

Dr. CLARKSON. Yes. I believe we have provided for the activities provided for in the Harvey bill. We have omitted the setting up of the special administration. We have provided for flexibility in the appointment of employees, and for flexibility in giving grants to nonprofit institutions.

Mr. HARVEY. I do not want to seem to belabor this fact, but is it not true that a great deal of the ultimate good that can come from this effort has to be the development and demonstration of research knowledge that you already have?

Dr. CLARKSON. That is correct. The items that Dr. Hilbert presented to the committee are items, the initial ideas of which have come from work——

Mr. HARVEY. I do not want to seem critical, but do you not think the very thing that is important has not been properly stressed there in section 3? You do say in subsection (d):

**to acquire by construction, purchase, lease, loan, or gift real property needed to carry out the purposes of the act.**

Possibly for technical purposes that is enough to be said, but I think that it ought to be written into any piece of legislation that is prepared on this subject the importance of pilot plants and even small commercial establishments to highlight the development phase of this problem. I do not feel that you have properly emphasized that in this bill, in this proposed bill that accompanies your statement.

Dr. CLARKSON. At the top of page 2 of the revised bill, in the middle of the paragraph, it says:

**Research, pilot plant and developmental work, and corollary economic and related studies should be devoted to the expansion of industrial uses for agricultural commodities in surplus * * *.**

That gives color to paragraph (d) that you referred to, and it is the intention that the acquisition of property would include pilot plants and development plants. We had no intention to engage in manufacturing for commercial distribution, of course, and we very carefully worded this so that such would not be included.

Mr. DIXON. To what extent is industry making inroads upon your best research workers?

Dr. CLARKSON. The field becomes increasingly more competitive. The Congress has granted increases for Federal employees from time to time, but industry is able to outbid us on the men that they really want, and it is very difficult to get and to obtain the necessary numbers of the highest quality research people. We can retain those who have a personal dedication to public service, but industry is constantly out-

bidding us on the dollar side of the market, and that is one reason for our request for relief to the extent of a maximum of 100 highly qualified scientific persons.

Mr. DIXON. That is why I asked the question. Industry is constantly knocking the props right out from underneath you?

Dr. CLARKSON. Yes.

Mr. DIXON. I know that to be a fact. In Russia I understand they have more than twice as many engineers coming out of their colleges as we have, and that the great proportion of all of their engineers go into Government service. They have to. But the great percentage of our engineers are going into industry because industry is outbidding the Government, and outbidding our colleges. We cannot even get instructors and research people to teach. That is the thing that alarms me, so I am glad that you have a feature in your proposal that will allow you some latitude to get the best research people, because there is no such thing as a mediocre research man. He just ought to be out. You have to have the best, or none at all, is that not true?

Dr. CLARKSON. I think that is true. We feel very strongly this provision will be necessary to enable us to accomplish the purposes that these bills are intended to accomplish.

Mr. JENNINGS. What is industry using these technicians for? Are they using them for research and development and new uses of agricultural products?

Dr. CLARKSON. They use them for research, development, production controls, production improvement, and all along the way.

Mr. JENNINGS. They are being used for the same purpose by industry that we would be using them for in Government; is that correct?

Dr. CLARKSON. To some extent, that is true. There are many of them that do not go into research work but go into the production-line type of work. There is some truth in what you say, there is employment for research people. To get them you have to bid on the market.

Mr. JENNINGS. The mere fact that we do not get them in Government does not mean that their services are lost to the American people. Industry is using them for the enhancement of these values we talk about in this bill—maybe not to the same extent and maybe not in the same direction.

Dr. CLARKSON. I think that is the essence of it. If you want to go in this direction, you must have the people who are doing the work to carry this out.

Mr. JENNINGS. Industry is doing a certain amount of work in discovery to find new uses of agricultural products; is that not correct?

Dr. CLARKSON. That is correct.

Mr. ABERNETHY. I would like to ask you a question that I overlooked a moment ago. In some of the papers filed here you refer to a "crash" program. What do you mean by a "crash" program?

Dr. HILBERT. We mean the type of program that has been carried on by the Atomic Energy Commission in the development of the atomic bomb, and uses of atomic energy, and the type of program the Department of Defense has had in the last 15 years in the development of new equipment. In other words, the emphasis is on speed to obtain the objective rather than to obtain the objective most eco-

nomically, which might take a long time. That is what is meant by a "crash" program.

Mr. ABERNETHY. I understand that. Is there anything further? We certainly thank you gentlemen for coming up and giving us the benefit of your views.

Dr. Clarkson, we are particularly grateful to you.

Dr. HILBERT. I have several statements here which you may wish to have included in the record.

Mr. ABERNETHY. Will you identify and hand them to the reporter?

Dr. HILBERT. I also have a statement that I prepared as Director of Utilization Research.

Mr. ABERNETHY. It will be inserted in the record at this point.

(The statement referred to is as follows:)

STATEMENT OF G. E. HILBERT, DIRECTOR OF UTILIZATION RESEARCH, ARS, USDA

I appreciate meeting with you today and having the opportunity of describing some of the contributions made by the regional research laboratories in developing new and extended uses for farm crops. First, I would like to review briefly the work done by the Government in this general field before the regional laboratories were established.

The first work in agricultural chemistry was carried on in 1841 in the Agricultural Division of the Patent Office. The Department of Agriculture entered into operation on July 1, 1862, and replaced the Agricultural Division of the Patent Office. At the same time, the Division of Chemistry was established as the first scientific unit of the newly created Department of Agriculture. The group in the Chemical Division was very small until after Dr. Harvey W. Wiley became its chief in 1883. He held this office for 29 years. During this period the personnel of this unit grew from 3 to over 500. The major attention of the group, however, was devoted to the purity of foods and drugs rather than utilization research. These activities led to the enactment of the Food and Drugs Act of 1906. By this time the Division of Chemistry was raised to the rank of a bureau. Much of the work of the Bureau of Chemistry with the passage of this act was shifted to regulatory activities. In the reorganization of the Department in 1927, the function of enforcing this act was transferred to the Food, Drug, and Insecticide Administration. In this change the Bureau of Chemistry was renamed the Bureau of Chemistry and Soils. After the reorganization, about 100 research workers from the former Bureau of Chemistry continued their efforts to seek more knowledge on the chemistry, processing, and utilization of farm crops. In the thirties increasing attention was devoted by the Bureau of Chemistry and Soils to research on the utilization of farm crops.

The first major expansion in the Department of research on the utilization of farm crops came with the establishment of the four large regional research laboratories. These laboratories were established in New Orleans, La., Peoria, Ill., Albany, Calif., and Wyndmoor, Pa.

The legislation authorizing the four regional laboratories was contained in the Agricultural Adjustment Act passed in 1938. One section of the bill stipulated that the purpose was "to conduct research into and to develop new scientific, chemical, and technical uses and new and extended markets and outlets for farm commodities and products and byproducts thereof." Further, "Such research and development shall be devoted primarily to those farm commodities in which there are regular or seasonal surpluses."

That was the charter. It represented a new front of attack in the general program of the Government on the major agricultural surplus problems which then existed. In essence, too, it represented a major challenge to science and technology to aid in solving this farm problem.

Congress gave the Department a great deal of flexibility in the development of the program and in the choice of problems. In the overall program, however, Congress requested the Department to investigate thoroughly two problems: The alcohol motor-fuels problem, and the use of cotton in tire cord. These two problems were controversial ones during the late 1930's.

Farm interests were urging the conversion of surplus grains for the production of alcohol for use in motor fuels. The petroleum industry on the other hand

claimed the use of alcohol in motor fuels was impracticable and that alcohol was a poor motor fuel. Farm organizations contended otherwise.

A similar controversy was being waged between the cotton interests and the rayon industry in the use of cotton in the fabrication of tire cord. The rayon industry claimed that rayon was much superior to cotton. Rayon at the time was rapidly replacing cotton in the tire-cord market. This was a serious blow to the cotton industry. Tire cord represented one of the largest single outlets for cotton. The quantity of cotton used in the production of tire cord was equivalent to about 600,000 bales of cotton.

Due to the controversial nature of these problems, and to the many claims and counterclaims being made, Congress believed that the Department should get the facts in the matter. As a result, a large team of 50 scientists, representing one-third of the entire group on the cotton program, devoted its attention to the tire-cord problem. An equally large team attacked the alcohol motor-fuels problem.

Just as we were well started on our research program, World War II intervened. The emphasis of our program was then shifted to defense purposes. Most agricultural surpluses, because of war needs, were wiped out very quickly. Instead of finding uses for surpluses, we were confronted with the situation of conducting research on extending existing supplies, developing substitutes, conducting research on dehydrated foods for use by the armed services, and many other activities.

For example, the War Production Board requested us to develop high-speed equipment for cutting high-priced cotton lint into lower-priced linters. Cotton lint was in large supply and linters in short supply, being in demand for the production of explosives. The War Production Board also requested us to coordinate all research work underway on the conversion of wheat to alcohol for use in the synthetic-rubber program. Normally, wheat is too high priced to be competitive with other raw materials for this purpose.

At the end of World War II, we again resumed our long-term program on developing new and extended uses for surplus crops.

In 1950, with the outbreak of Korean hostilities, our program again was shifted to defense activities. In 1953, we redirected our investigations to the surplus problem.

It is evident that during the past 15 years approximately half of our time has been diverted from the surplus problem to defense activities. However, this has not been altogether unfavorable. The speed with which some of our developments were translated into industry was accelerated because of the urgency and need for the products we developed. Some commodities were benefited by these activities, such as cotton, fruits and vegetables, and oils and fats. Our program on corn and wheat, however, was retarded by this defense work.

I would like now to describe some of the major contributions made in this program.

There are two types of surpluses—seasonal surpluses of perishable commodities, and annual surpluses of stable commodities. First, I will discuss the perishable group which, of course, includes fruits, vegetables, and eggs. Most of our research on this class of commodities has been directed toward the development of methods for converting them to a stable, palatable, convenient-to-use form so that they are preserved and available throughout the year. This conversion to a year-round product tends to stabilize the price of these commodities. Foods in a convenient-to-use form provide an incentive for the housewife to purchase them.

The Department and the Congress can take justifiable pride in the part played by Federal research in the genesis and growth of the great frozen-food industry. We sometimes forget that frozen foods, as millions of Americans now know them, first appeared in a few markets in the early 1930's, and that this billion-dollar industry first stood on its feet during the great depression. In a striking example of far-sighted vision of needs and opportunities, the Department established a special laboratory in Seattle at the critical moment in the year 1930, and staffed it with vigorous, far-seeing scientists. There was already a considerable industry in that area engaged in freezing berries and some other fruits in large containers for use by ice-cream manufacturers and commercial pie bakers. Experimentation with the freezing of fruits and vegetables in small packages for the retail trade was going on in a number of places. Results were uneven; often definitely unsatisfactory. The soundness of the whole future structure was in balance; the successful outcome is history.

Improvements in quality and in lowering processing costs did not end with the pioneering feat of the Frozen Pack Laboratory in Seattle. With the establishment of the regional research laboratories, our program on frozen foods was accelerated. Many contributions have been made in solving the new problems that were arising continually from the enormous growth and diversification of an industry that has become a major channel for utilization of many of our food commodities.

Not only the frozen-food industry of the Northwest, but also the entire industry, has acknowledged on many occasions the debt it owes to the scientists and technologists of the Department. These men tackled problems that were entirely beyond the powers of the industry, found the answers, and by precept and example, showed the industry how to meet them.

Another important contribution we have made in this field is on the development of frozen concentrated orange juice. At the end of World War II, the industry was deeply concerned that it would be faced with serious orange surpluses. There even were discussions on the possible need for Government price supports. In 1943, our Winter Haven Laboratory, in cooperation with the Florida Citrus Commission, developed the basic process for producing frozen concentrated orange juice. The patent on this process was dedicated to the Secretary of Agriculture for use by industry on a royalty-free basis.

The citrus-processing industry had the vision to follow through vigorously on this development. The product has been widely accepted by consumers because it can be stored for more than a year, is convenient to use, and when properly processed and marketed has practically the same flavor and quality as fresh juice. The industry has mushroomed since that time, and the expanded production of oranges has been absorbed without difficulty. This development has thus prevented a surplus problem from arising. At the present time, no less than 50 percent of all Florida oranges produced are converted into frozen concentrated juice.

This development has stimulated the production of other frozen concentrated fruit juices. Some of these are frozen concentrated lemon, lime, tangerine, grapefruit, grape, and apple juices. Of these, frozen lemonade concentrate has been particularly well received, and its production has increased markedly in the past few years. It has had a helpful stabilizing effect on industry.

Fruit and vegetable juices also can be converted into another stable, palatable, convenient-to-use form, and that is as powders. During World War II, fruit and vegetable powders were produced extensively for the armed services; however, the products had lost much of the flavor of the original juice, and dissolved very slowly in water. The process we have developed yields powders which have the full flavor of the original raw product. Orange, lemon, grapefruit, apple prune, grape, and tomato powders now can be made. Due to the excellent storage stability, these powdered juices can be stored on the kitchen shelf with other staples and can be reconstituted quickly by the addition of water—even ice water.

A great deal of commercial interest has arisen in fruit and tomato juice powders. A plant in Florida has been producing orange juice powder for a year and a half. The construction of a plant for the production of tomato juice powder was completed a few months ago and is making preliminary commercial runs to produce tomato juice powder. Two companies are producing pineapple and lemonade juice powders on a pilot-plant scale. This development has great promise and is expected to have a tremendous impact upon our fruit and vegetable industry.

The commercialization of potato granules, or instant potato, has moved ahead rapidly in the last 2 years. The knowledge we have developed in increasing the storage life of instant potato and in developing equipment for its production has been responsible for the success of this development. The instant potato now being produced can be converted quickly and conveniently into the mash form in the kitchen. The mashed potatoes are indistinguishable from the product made with fresh potatoes. Five companies which have adopted our findings are now producing this form of dehydrated potato. The domestic demand is so great that the industry has been having difficulty in supplying the market. This industry will continue to expand. We believe this development will do for the potato industry what frozen concentrated orange juice has done for the citrus industry.

The same is true of eggs. The egg industry has been faced with seasonal surpluses periodically. Preservation of eggs by freezing has been practiced widely and is helping to stabilize the market. Powdered eggs that can be

stored and still be as palatable as fresh eggs is quite a recent development. All of us remember the dehydrated eggs that were available during World War II; they simply did not stand up in storage. Several years ago, we discovered the cause of the rapid development of off-flavors in dried eggs. Through appropriate processing and drying we have overcome this difficulty. Several companies are now producing this improved type of dried egg powder. It is being used by the Armed Forces and commercially, particularly in the manufacture of baking premixes. The production of dried eggs has been averaging about 20 million pounds a year. This development is making a signficant contribution toward stabilizing the egg industry. There is still one problem to be solved, and upon which we are working—that is to produce the dried egg powder in a convenient-to-use form. Such a convenient-to-use form of egg has promise in home use, particularly in the preparation of scrambled eggs.

I would like to discuss now the contributions we have made on storable surplus commodities.

The first one I will take up is cotton. Earlier, I mentioned that in the first years we devoted a great deal of attention to the use of cotton in tire cord. I would like to summarize our findings for you. Our work showed that cotton is just as good as rayon for making most tire cord. In actual road tests, we showed that the life of cotton cord is as good as that made from rayon when used in tires for passenger cars and light trucks, and in medium-sized heavy-duty tires for military trucks. However, the price of rayon cord is cheaper than that made from cotton.

The fundamental work we have done on cotton, however, has aided the use of our cotton in tire cord made in France. One French company using 40,000 bales of Egyptian cotton annually replaced this with our own Delta cotton a couple of years ago. The French company discovered that certain varieties of our own Delta cotton worked as well as Egyptian cotton. However, the company did not have any simple method for selecting the varieties of Delta cotton which are most suitable in tire cord. On the basis of the fundamental information we had developed, we were able to provide the company with a simple test method for selecting these cottons.

Perhaps the most significant contribution we have made in cotton is in the development of new equipment for lowering the cost of processing cotton in textile mills. Before cotton can be processed, the matted or compacted masses of fiber in a bale must be opened and fluffed to enable more efficient removal of the foreign matter from the fiber. A new cotton opener which we developed several years ago does this better than any other. With our machine, more trash, but less spinnable fiber, is removed in the processing operation. Savings are estimated by industry to amount to 50 cents to $1 per bale of cotton processed. The textile industry has already put into use enough of these machines to process 2 million bales of cotton annually, and new machines are being installed at a rate to handle an additional 500,000 bales each year. The basic patents on this opener have been dedicated to the Secretary of Agriculture. Four United States, and several foreign companies are manufacturing these openers.

We have made other improvements on equipment used in the processing of cotton. We have developed a simple attachment to a loom which permits the weaving of abnormally dense cotton fabrics having resistance to the passage of water and wind. The loom attachment we have developed is being produced commercially by two manufacturers.

By a thorough study of the carding of cotton, we have found how cotton card production can be increased greatly—by as much as 60 percent. The card is a standard piece of textile equipment in every textile mill; it disentangles individual cotton fibers and brings them into parallel alinement. In addition to increased production rates, it was found that waste in carding can be reduced about 1 percent. A number of mills have adopted our recommended changes in carding techniques. One medium-sized mill reported to us an estimated saving of about $170,000 a year.

We have done a great deal of work on improving the life of cotton fabrics with regard to resistance to the effects of weather, mildew, sunlight, and heat. The service life of cotton cloth used to shade seed beds and growing tobacco plants can be tripled by the process we have developed. This tobacco shade cloth is being produced commercially by two companies and is being used widely at the present time. This development has helped prevent displacement of cotton fabrics by those made from synthetic fibers.

Entirely new fibers with new and improved properties have been prepared from cotton by chemical modification. One such new product is acetylated

cotton. It has higher resistance to heat than cotton and most synthetic fibers, and is used in laundry press covers, and ironer roll covers in commercial laundries. Two firms are now manufacturing this new textile product.

One of the disadvantages of cotton fabrics has been the problem of soiling. We have developed an antisoiling treatment which invloves the use of a simple and inexpensive compound in laundry rinse waters. This makes cotton goods harder to soil and easier to clean. Preparations of the antisoiling compound are being manufactured by at least five companies for use as antisoiling treatments for cotton both at home and in commercial laundries.

An elastic, conforming, clinging cotton bandage developed by us during World War II, and produced commercially for the Armed Forces beginning in 1952, has now been made available for general civilian use. Two companies are actively producing and marketing the product.

Because of the lack of uniformity in cotton fibers, it is necessary to have accurate methods of measuring their properties in order to determine their best end usage. A number of new instruments have been developed and are in use for these purposes. A new dye technique for distinguishing between immature and mature fibers has been of great help to the industry in pinpointing processing problems. The relationship between length and strength of cotton fibers and the spinning of more uniform yarns has been appraised accurately and summarized in convenient-to-use charts for textile mills.

All these developments help to reduce processing costs and improve the quality of cotton fabrics, thus placing the cotton textile industry in a better competitive position with respect to synthetic fibers and aiding the cotton producer by retaining the markets for his product.

The next subject I will discuss is our contributions on fats and oils. Since the end of World War II production of oils and fats in this country has increased 50 percent, while consumption has increased only from 10 to 15 percent. The price of oils and fats has fluctuated quite widely during this period. Between 1950 and 1952 the price of inedible fats and oils, because of oversupply, dropped as low as 3½ cents per pound. Because fats and oils are interchangeable for most uses, a surplus of one fat or oil affects the price structure of all fats and oils.

The largest new use we have found for inedible fats is in the feed field. When the price of these fats dropped to 3½ cents a pound, inedible fats actually were cheaper, on a calorie basis, than almost any other feed. Before they could be used in feeds, however, it was necessary to show that fats in feeds had value, and that the fat could be stabilized suitable for such a purpose; this we showed. As a result of this research, the use of inedible fats in the feed industry expanded rapidly. The present annual consumption of fats in feeds is now about 250 million pounds. This expanded use for fats has been responsible largely for the increase in price of inedible fats from 3½ to 7 cents a pound.

Other new markets for inedible fats have been developed in the chemical industry, in the plastics industry, and in the hot-dip tinning of steels. Basic research on the development of improved grades of oleic acid has been translated to a commercial scale. Basic methods for the modification of oils and fats have resulted in their use as plasticizers or as stabilizers in plastics. From the earliest days of hot-dip tinning, imported palm oil has been used for this purpose. The work we have done and confirmed by pilot plant and full mill scale operations demonstrated that modified inedible tallow and greases perform even better than palm oil.

During World War II, we developed a new resin from soybean oil. This has been produced on a commercial scale for more than 10 years. It is used for the heat sealing of glassine paper and other food packaging materials. Recently, a paint company showed that the use of this resin in paints leads to the production of a gelled paint. More than 30 companies are now using the resin to manufacture gelled paints.

About 60 million pounds of fats and oils are now being used by industry for these various new uses.

During World War II, soaps made from tallow and grease were used as emulsifiers in the manufacture of synthetic rubber. In the early days of the industry, frequent variations in the rate of formation of rubber indicated that unknown substances in the soaps were acting as retarders. As a result, industry gave consideration to the use of synthetic emulsifiers. Our research work showed a way to overcome the difficulty with soap. This market for inedible fats was thus retained. About 25 million pounds of tallow are being used currently for this purpose.

We have also made marked advances in improving the quality and storage life of soybean and cottonseed oil. The changes we have recommended in the processing of oilseeds have been adopted by industry. As a result of improvements in the processing of cottonseed meal, about 250,000 tons of cottonseed meal went into mixed feeds for poultry and swine in 1954—a market heretofore closed to cottonseed meal. The meal sold for this market brought a premium of several dollars a ton.

These various contributions have led to improvements in the processing of oilseeds, in improving the quality and storage life of the oils, and to the development of large-volume outlets for surplus fats and oils.

The next topic I will cover is our research work on corn and wheat. Earlier I mentioned that one of our major activities on cereals involved the production and use of power alcohol. From these investigations valuable information was obtained on lowering the cost of the production of alcohol from grains. Our work has shown also that alcohol is an excellent motor fuel either as a blend or by direct injection into the motor. Alcohol-gasoline blends containing 10–25 percent alcohol can be used by engines of current model cars and tractors without loss in general performance, provided the fuel is properly blended. Alcohol has definite antiknock value and its wholesale fuel value in a 10-percent blend with gasoline is estimated to be about 24 cents per gallon. To produce alcohol competitive with gasoline, grain would have to sell at from 30 to 45 cents per bushel depending upon the size, location, and efficiency of the plant.

We know now that there is no technical problem in producing power alcohol from grain, and no technical problem in using it as a liquid fuel. We know, also, that the use of grains for the production of power alcohol literally would burn up any conceivable surplus we could have in this country. The key problem in this whole matter is the economic one.

Our defense activities during World War II and the Korean hostilities of necessity shifted much of our attention from the development of large-volume outlets for grains to problems of national significance. Two important contributions resulted from these studies: One was on the production of penicillin, and the other on dextran, a blood-plasma supplement.

The basic process for producing penicillin which we developed during World War II was adopted immediately by industry and is still in use. The basic patents on the production of penicillin were dedicated to the Secretary of Agriculture for use by industry on a royalty-free basis. For this contribution our NURB received one of the Lasker medical awards.

The process we developed, and the micro-organism we discovered for producing dextran during the Korean hostilities, has been taken up by industry. Large quantities of dextran made by our process have been stockpiled by the Department of Defense. A number of years ago civilian hospitals began to use dextran as a blood plasma supplement.

Both of these accomplishments are of greater significance nationally than from the standpoint of the contribution they have made in developing new outlets for surpluses. Although agricultural raw materials are used in producing penicillin and dextran, the quantities are relatively small. From the national standpoint, however, these contributions have been of inestimable value.

Several new fermentation uses for corn which we developed have been commercialized. A new outlet for corn is its fermentation to produce a feed rich in the vitamin riboflavin. A number of companies are using this process now. Approximately one-half of the current production in vitamin $B_{12}$ is produced by new fermentation methods which we discovered. Another process concerns the production of vitamin $B_{12}$ and an antibiotic which produces favorable growth responses. This also has been translated to a commercial scale. The ready and economic availability of vitamin $B_{12}$ for chick and swine nutrition has contributed greatly to the more efficient production of these important farm commodities. It has been an important factor in their expanded production. This, in turn, has resulted in increased utilization of large quantities of corn.

Processes which we have developed for the production of calcium gluconate and sodium gluconate have also been adopted by industry. Sodium gluconate is being produced in increasing quantities for use in the clarification of detergent solutions used in the bottle-washing industry.

A process which we have developed for producing a new type of protein fiber from corn gluten was commercialized several years ago. This new type of fiber, called Vicara, is being produced in large quantities and has properties quite similar to cashmere.

Our research, done in cooperation with private breeders and the Iowa State Experiment Station, has led to the introduction of a new type of corn called waxy corn. Waxy corn produces a unique type of starch which is finding increased use in the pudding and adhesive industry. Several million bushels of this corn are now produced in the Middle West, and its production is expanding.

In part, because of our defense activities, less progress has been made on wheat than on any of the other commodities upon which we have worked. During World War II our research was concerned with extending the uses of wheat in established industries. For example, we developed a process for separating wheat flour into gluten and starch. A number of companies used our process for producing dextrose from the starch. This dextrose was used as an extender for cane and beet sugar which were in short supply. After the war, when dextrose from corn and sugar were freely available, the production of a sweetener from wheat ceased. We were requested by the War Production Board to coordinate all activities on the production of alcohol from wheat. The alcohol was used for the production of synthetic rubber. More than 150 million bushels of wheat were used for this purpose. This operation also stopped after the war when our need for feeding Europe was great.

Within the last 2 years we have shifted major emphasis to the development of new and expanded food and industrial uses of wheat. Dr. Maclay, Chief of our NURB, will elaborate upon the progress that has been made on this problem.

At the time the regional laboratories were established, it was impossible, of course, to predict the results that would stem from this research. Some groups then believed that little in the form of accomplishments would issue from these laboratories. In the report of the survey made by the Department of Agriculture relative to the four regional laboratories, published in 1939 as Senate Document 65, it was pointed out that "all research work is founded upon the faith that, in the long run, knowledge is a better guide to human action than ignorance."

The regional laboratories have been in operation more than 15 years. We are now in a position to assess their contributions. I have called many of these to your attention. Because of the limited time for my presentation, it has not been possible to describe all of them. I have not discussed our contributions on rice, gum rosin and turpentine, hides and skins, alfalfa, maple sirup and honey, wheat straw and corncobs, tung nuts and cane and beet sugar. All told, more than 100 of our contributions have been commercialized. In addition to these, many fundamental contributions have been made in expanding our knowledge in the field of science. These are of great, although intangible, value. This kind of information provides the building blocks for future contributions by research scientists in other organizations as well as our own. It is an investment upon which we will receive dividends for many years to come.

In summary, the Department believes that the return to the farmer and the Nation from this utilization research work has much more than offset the cost of the program. We also believe that if the funds available for this research had been larger, our contributions would have been commensurately greater.

Dr. HILBERT. I have a statement on the contributions made by the regional research laboratories on the developments of new uses for agricultural commodities, and there have been more than 120 of our developments which have been translated to commercial scale.

I have a statement by Dr. Maclay, who is the Chief of the Northern Utilization Research Branch, who refers to some of the most promising developments underway at the Northern Laboratory at the present time.

I have similar statements from Dr. Fisher, who is the Chief of the Southern Utilization Research Branch, and by Dr. Sam R. Hoover, Assistant Chief of the Eastern Utilization Research Branch, and by Dr. Copley, Chief of the Western Utilization Branch.

Mr. ABERNETHY. They will be included in the record at this point.

(The statements referred to are as follows:)

STATEMENT BY W. D. MACLAY, CHIEF, NORTHERN UTILIZATION RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

Mr. Chairman and members of the committee, the major research effort of the Northern Branch is directed toward the utilization of cereal grains and oilseeds. I appreciate the opportunity to describe some of our current results and the very considerable opportunities which we now have for making signal gains in the development of larger outlets for wheat, corn, soybeans, and flaxseed through an intensified research program.

*Fermentation of grain into high quality microbial protein*

Swine and poultry in the United States annually consume about 75 million tons of feed. Cereal grains are the basis for this feed and, generally, compose 50 percent or more of the ration. However, the proteins of cereal grains are deficient in certain essential amino acids necessary for best reproduction and for rapid, economic growth of young animals. Large amounts of lysine and methionine, in particular, are lacking. The National Research Council has compiled estimates on the requirements for amino acids by swine and poultry. For example, the requirement of the present yearly population of these animals amounts to 175,000 tons of lysine, in addition to the amount found in existing rations. The use of protein feed supplements rich in such critical amino acids would lead to more economical production of swine and poultry. Lower costs would stimulate increased consumption which, in turn, would lead to increased utilization of grain for feeds.

We believe the most economical and practical method of getting the needed protein quality is to ferment grain by micro-organisms which will yield a protein containing 20 percent, or more, of the desired amino acid. In this manner grain would be used to produce the high quality protein required to supplement grain feeds. In research currently under way, we have found micro-organisms with protein containing up to 12 percent lysine. We believe that much higher levels of the desired amino acids can be obtained through artificially induced mutations and through studies of the nutritional requirements of the micro-organisms.

The goal of this research is to produce a protein containing 20 percent lysine. If successful the fermentation of 1 bushel of grain will give enough product to fortify 3 additional bushels of grain up to the recommended level for this amino acid. On this basis, it would require the fermentation of about 175 million bushels of grain to produce the lysine to meet the annual needs based on the National Research Council's recommendations.

*Dialdehyde starch—a new chemical*

An economical process has been developed at the Northern Branch for converting grain starch into a new chemical raw material, called dialdehyde starch. Depending on the degree of conversion of the starch, a whole series of products are obtained. The dialdehyde starches are radically different in properties from the starting material and from other available commercial chemicals. Their chemical and physical properties are such that there is high probability that either the products or certain chemicals derived from them will find outlets in the markets represented by 240 million pounds of imported vegetable tannins, a billion pounds of polyalcohols derived largely from petroleum sources, 800 million pounds of plastics, and several other smaller volume outlets which, in the aggregate, have considerable importance. Additional opportunity exists for extended use of certain of the products as improved coatings and sizing agents in the paper and textile fields, which already consume 900 million pounds of cereal starch annually.

A laboratory method for the production of dialdehyde starches has been developed. Work on a larger scale process is now underway. Limited studies of the utility of the dialdehyde starches have shown their high promise in a number of applications. Early tests show them to act as a rapid and effective vegetable-type tanning agent for leather. They can be converted into a strong, tough plastic. Chemicals, such as polyalcohols, for use in protective coatings have been made from them in good yield. Full exploitation of their market potential, however, will require research along several routes to determine the wide variety of uses they can serve. Their highly reactive nature makes them of value both as versatile products for use as such, as well as raw materials for conversion into other chemical derivatives.

In our opinion, this development is one of the most encouraging for new products thus far made from cereal grains.

*Starch in paper and paper products*

A large potential market for cereal starches exists in the expanding paper and paper-products industry, which now makes about 30 million tons of products annually. As part of this total, nearly 8 million tons of pulp and finished paper are imported to meet the needs of the domestic pulp and newsprint industries. Indications are that domestic supplies of pulp will become increasingly short of meeting the needs of the paper industry. A large opportunity exists here for a material which will supplement or extend the supply of pulp. It is our conviction that starch is the one product that can most nearly meet the requirements. This may be accomplished by the development of starches or starch products which have superior strength and adhesion properties. They would be applied in conventional manner as a sizing or coating by chemical combination with the pulp or by incorporation of preformed starch fibers in the pulp.

Research at the Northern Branch has demonstrated that a chemical fraction of starch called amylose, comprising about one-fourth of cereal starches, forms films comparable in strength to those made by the regeneration of dissolved wood fibers. Chemical derivatives of amylose also have been made in the laboratory and converted to films and fibers having considerable strength and water resistance. The incorporation of amylose or its derivatives into paper or paper products would be expected, therefore, to contribute desirable tensile strength and other physical properties. The separation of amylose from ordinary starch has been impractical because of the small amount present. A new approach was made, however, through our cooperative research with corn breeders. As a result, new high-yielding corn hybrids have been developed containing more than twice as much amylose as found in normal cereal starches. Prospects are excellent that the amylose content of the starch of these new hybrids soon will be increased to the point where we shall have available a starch of great practical value in the paper industry.

Increased use of cereal starches in paper and paper products may also be based on investigation made at the Northern Branch dealing with the chemicals reactions of starch and starch derivatives. These findings include (1) methods for improving the adhesion and water resistance of ordinary starch and starch products incorporated in pulp products, and (2) chemical reactions which can be used to chemically bind the starch to the pulp.

The research program now planned includes the development of (1) optimum conditions for separation of the high-amylose starch, (2) practical methods for preparation of fibers from the high-amylose and ordinary starches and their derivatives, and (3) methods for incorporation of maximum effective amounts of these starches or their modifications in paper and paper products. The full potential market for cereal starches in the pulp and paper industry will be realized when such technological problems are solved.

*Industrial polymers by fermentation*

We have another field of work involving the production of polymers, a name the chemist uses to describe substances of very high molecular weight. A number of polymers such as gums, sizing agents, films, plastics, and synthetic fibers, are used in many industrial applications. The total annual domestic production and imports of such polymer materials is estimated to be about 2 billion pounds. Expansion of industrial uses for ordinary cereal starch is dependent largely upon its conversion into materials with a new range of properties. We now have methods for producing such materials which, in many ways, are more versatile than either the chemical or plant breeding approaches. They are based on the scientific control of selected micro-organisms to produce the types of materials wanted. Thousands of different kinds of yeasts, molds, and bacteria are known to produce a great diversity of products, including polymers. This approach has already been used with high success at the northern branch in developing the processes used in this country and abroad for producing all, or most, of the penicillin, dextran, and gluconic acid, and much of our vitamins $B_2$ and $B_{12}$, widely used in animal feeds.

Our research has gone far enough now to show that micro-organisms produce many materials from grain of industrial value. Included are products such as gums, extremely stable plasticlike materials, sizing agents for synthetic fibers, vitamin A, and related carotenoids, and rubberlike materials.

This research program includes an exhaustive search for the particular strains of micro-organisms that produce the desired products in best yield and the devel-

opment of processes giving maximum quality and yields. Finally, comes the evaluation of the products for specific new end uses.

On the basis of our experience in fermentations we have every confidence that new efforts in this area will yield results of equal and greater importance to grain utilization than the best of our past accomplishments.

*Organic acids by fermentation*

Organic acids represent a class of chemicals many of which can be produced in good yield through the fermentation of grain products. Four such acids—citric, fumaric, itaconic, and gluconic—are being manufactured commercially. Department research has played an important role in these developments. Certain of these acids have been used, to a limited extent, in special rubbers, plastics, industrial finishes, and cleansing agents. The total amount of the chemicals used in these general fields amounts to around 2.5 billion pounds annually, with a value of about a billion dollars. As an example of the results of our recent research, one company is using our process to make 3 million pounds per year of an acid derivative for use in washing bottles, milk cans, and in aluminum etching compounds.

The problem for research on these materials is twofold; (1) To develop more economic methods by either increasing yields or by reducing the time required for fermentation, and (2) to find new large uses for the acids and their derivatives as chemicals, raw materials, or finished products. In the first case, we are finding encouraging economies in the production of both citric and fumaric acids. There is considerable industrial interest in our results. With respect to the development of new outlets for the acids and their derived products, less work has been completed. However, from the nature of what leads we have thus far, it is believed that both itaconic and fumaric acids will find expanded use in making special types of synthetic rubber and plastics. Prosecution of this type of work according to present plans holds much promise for the increased consumption of cereals, starches, and starch products.

*Increased consumption of bread and bakery products through quality improvements*

There has been a steady decline in the United States per capita consumption of wheat over the last half century. In the last 15 years alone the decrease has been nearly 20 percent. If each person today ate as much bread as he did 15 years ago, we would consume about 100 million bushels more wheat per year. To do this each person would have to eat bread or other bakery products equivalent to but 2 more slices of bread per day. We believe the trend downward can be stopped, or even reversed, by intensive research and development that will put more palatable, convenient, nutritious, and economical baked products in the hands of the consumer.

Consumer-preference surveys conducted by the Department have shown that freshness is the quality factor rated highest in determining the acceptability of bread. It is therefore essential that means be found to market bread as nearly in its oven-fresh condition as possible. At our Northern and Western Utilization Research Branches we are actively carrying out several lines of work toward this end.

Experiments on the application of quick-freezing techniques have shown that deterioration of quality can be prevented if the freshly baked product is properly frozen and handled. We believe this can be made into a practical method of processing and distribution. Studies on the nature of the deteriorations which take place on staling show that the starch in bread undergoes a change in its physical state as the bread ages and becomes stale. Laboratory trials with experimental loaves, formulated to prevent this change in the starch, have shown that bread of greatly improved keeping quality can be made. Also, new and promising leads have been developed in our search for dough improvers which are expected to produce bread of better quality with less tendency to stale. The significant progress made in the separation and identification of constituents responsible for aroma, flavor, and keeping quality is basic to developing means for maintaining these desired qualities.

Completion of the research and translation of the findings mentioned above into practical use will result in significant contribution to our goal—enlarged consumption of bread and bakery products.

*New industrial products from soybean and linseed oils*

As all of us know, large quantities of soybean and linseed oils are used each year in paints, varnishes, and special industrial coatings. However, in the last

20 years the amount of oil used in a gallon of paint has dropped from 2.4 to 1.4 pounds. This decline has come about largely through the replacement of vegetable oils by products made from petroleum and coal. Fortunately, this occurred during a period of expanding markets for paints, so the total overall use did show a slight increase. If the composition of our paints were the same as 20 years ago, we would be using half a billion more pounds of vegetable oils.

The present exacting requirements for various qualities in paints, such as durability, color stability, rapid air drying or baking, lack of odor, and low fire hazard, can no longer be met just by mixing drying oils, pigments, and driers. The comparatively small amount of research effort on vegetable drying oils has permitted only limited success in meeting the competition from synthetic products derived from petroleum and coal. The need is for research which has for its object (1) the determination of the chemical factors in the oil responsible for its quality and (2) the discovery of the chemical reactions through which it can be converted into improved materials for paints.

As a result of such research we have made chemically modified oils which bake rapidly to give hard and durable finishes. Because the new products are based on commercially available materials and can be readily prepared in good yields, we believe that continued research to develop the products on a practicable basis would be most profitable. Other reactions leading to new and improved derivatives are being studied in order to develop commercial products as a part of our program to realize for soybean and linseed oils much of this additional market of one-half billion pounds in paints.

In addition to the use of vegetable oils in paints, a major opportunity for substantially increased utilization of linseed and soybean oils lies in the broad field of industrial chemical products. This field comprises such end-uses as plastics and softeners for plastics, special lubricants for use at lov' temperatures, rubberlike materials, and stabilizers for asphalt and other compositions used for roadbuilding. At the present time these end-uses represent a market of about 6 billion pounds of chemicals per year, and the demand is expanding rapidly. Because of the tremendous amount of research done on synthetic organic chemicals from petroleum and coal, they have captured most of this market. Current use of soybean and linseed oils in synthetic nondrying oil products is less than 0.2 billion pounds. The figures of 6 billion and 0.2 billion reflect the relative expenditures for research on the use of the mineral and vegetable raw materials.

To expand the use of linseed and soybean oils, it is necessary to discover and develop new derivatives from these oils that can compete with synthetics in quality and price. At the Northern Branch, we are engaged in a promising line of work devoted to developing new chemical products from soybean oil. New types of derivatives have been discovered that look suitable as new materials for making plastics and softeners and stabilizers for plastics. Limited evaluation of these softeners indicate that they may prove to be superior to many softeners now on the market. Studies are also underway on the further evaluation of these softeners and on their production to determine their utility and cost. We are exploring the production of plastics from these new derivatives. As softeners and stabilizers alone, our new derivatives might be used to the extent of 30 million pounds. Our research also has opened brandnew fields for investigation through the discovery of new reactions of these oils which could lead to their greater use in a variety of synthetics.

Mr. Chairman and members of the committee, I hope that this brief description of several of our more important areas of research has served to illustrate both the objectives and the future possibilities of research directed toward the utilization of cereal grains and oilseeds. May I, again, express my appreciation for the time you have allotted to discuss these matters with you.

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STATEMENT BY C. H. FISHER, CHIEF, SOUTHERN UTILIZATION RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

Mr. Chairman and members of the committee, I wish to thank you for the privilege of bringing to your attention some of the more important and promising areas of research that are being conducted in the Southern Utilization Research Branch to give relief to the cotton surplus problem.

Because of severe competition from synthetic fibers, plastics, glass, paper, and metals, we can expect the cotton problem to become worse, instead of better,

if we don't do adequate and effective research to hold and expand existing markets for cotton and to develop new markets.

The volume of research on competing materials, which have only about 40 percent of the monetary value of cotton, is probably more than 8 times that devoted to cotton. This situation has stemmed from the conviction of the industries manufacturing the competitive materials that it is profitable to do research aimed at capturing more of the textile market because of the richness of the prize: about $2 billion at the farm level and about 10 to 12 billion dollars at the retail level.

Our program on cotton, which has been developed in close cooperation with technical advisers from industry, trade associations and other organizations, is designed to strengthen the competitive position of cotton through research to enhance the value of cotton in its major markets, improve quality and lower costs, and develop new uses.

*Weather-resistant cottons to compete with synthetic fibers, metals, and plastics*

Although cotton still is the principal textile fiber used in making "outdoor" fabrics, this 250,000-bale market (awnings, tarpaulins, tents, field covering, umbrellas, etc.) has been losing ground to synthetic fibers, metals, and plastics. Susceptibility to degradation by light and micro-organisms constitutes the principal weaknesses of cotton in outdoor fabrics. Much work has been done by various organizations to find practical methods for retarding or preventing deterioration to retain these important markets for cotton. Definite progress has been made in this type of research in the Southern Branch. Current work promises to bring even more important advances.

In one approach, cotton has been made unusually resistant to weather degradation by first dyeing it with certain light-stable vat dyes and then treating the dyed cotton with acetic anhydride, a low-cost chemical. The combined treatment yields products that resist degradation caused by both sunlight and rotting. The net result is that the weather resistance—or service life outdoors—is increased twofold or threefold.

Other research at the Southern Branch conducted in cooperation with the National Canvas Goods Manufacturers' Association is directed toward improvement of the performance of cotton canvas by the development of more effective and lighter-weight weather- and rot-resistant treatments for awnings, tarpaulins, and tents. This work includes improving the coatings applied to canvas awnings so that the attractiveness and decorative aspects of the awnings (brighter and more stable colors) will be enhanced. Current and expected achievements should result in increased consumer acceptance of these products and increased utilization of cotton.

*Flame-resistant cottons to enhance the competitive position of cotton*

We believe that the research now underway in the Southern Branch to develop flame-resistant cotton fabrics will improve the competitive position of cotton. In addition, it is important to have improved flame-resistant textile products because an estimated 1,500 persons die and 3 times this number are injured annually in the United States from fires associated with burning fabrics.

Because of our improved standard of living, and a growing awareness of the hazards presented by flammable textiles, the consumer is developing more interest in flame-resistant fabrics. In the future it is likely that the consumer will give increasing consideration to flame resistance (particularly for baby blankets, dresses, and other items having a direct bearing on personal safety) when choosing between cotton and synthetic textile products. This is suggested by the regulations of most large cities requiring flame-resistant fabrics in public places, and by the Flammable Fabrics Act, which prohibits the movement of highly flammable fabrics in interstate commerce. In achieving flame resistance, the advantage lie distinctly with cotton because it is more amendable to treatment with flame retardants than the manmade fibers (with the exception of viscose rayon). For this reason, and because flame resistance is important also in foreign markets, research on flame resistance presents an unusually attractive opportunity of strengthening the competitive position of cotton and increasing its consumption both at home and abroad.

In a broad program conducted by the Southern Branch in cooperation with the Quartermaster Corps and other organizations, two effective flame-resistant treatments that provide cottons durable to laundering and drycleaning have already been invented. Several textile finishing companies are applying one of these commercially to considerable yardages of cotton fabrics, and the other

flame retardant is ready for commercial use. Cotton fabrics treated with a combination of the two retardants pass the most stringent tests.

Although these flame retardants for cotton are excellent, we have already discovered other treatments that, on the basis of limited laboratory work, appear to be even better. We feel confident that further work on flame retardants will not only reduce the death rate and property loss resulting from our present flammable textiles, but will also increase the attractiveness and consumption of cotton in competition with other fibers.

*New chemical fibers from cotton having special properties needed for specific end uses, including some of those now served by manmade fibers*

Cotton, our most versatile general-purpose fiber, has enjoyed a strong position for many of the older conventional textile uses. As our economy has been made more complicated by technical advances, however, additional end uses requiring special properties have been created. Cotton has been able to compete successfully for some of these end uses, but other fibers—because of certain special properties—serve some of the old and new end uses better.

The factor primarily responsible for the selection of the manmade fibers for some uses is their hydrophobic or water-resistant characteristic. Other properties responsible for the success of the manmade fibers for certain end uses are resistance to heat, acids, and other chemicals and resistance to deterioration caused by weathering and micro-organisms. While these properties have some importance for wearing apparel and household goods, they are particularly important for textile products going into industrial uses. Because industrial uses still constitute almost one-fourth of cotton's total domestic market (3 million bales in 1946 and 2 million bales in 1953), it is highly important to develop methods for imparting new and special properties to cotton.

This means that we must learn how to tailor-make cotton to give it the particular properties needed for specific end uses. Pioneering research at the southern branch has developed several new fibers from cotton having new and special properties. One, called PA cotton, is already in limited commercial production. Having outstanding resistance to deterioration caused by heat and micro-organisms, PA cotton has unusually long service life on commercial laundry presses, household ironing-board covers, and in sandbags exposed on damp ground. In 1952, about 1 million bales of cotton and large quantities of manmade fibers went into uses for which PA cotton could have been used advantageously. Research to effect further improvements in PA cotton might increase the utilization of this cotton product at the expense of the manmade fibers.

Several new chemical fibers from cotton are being investigated in the laboratory and some of them are ready for commercial trial. Among these new fibers from cotton are those with water-resistant properties, increased soil resistance, increased water solubility, increased or decreased amenability to dyeing, nonstaining characteristics, new elastic properties, and strength even greater than that of the untreated cotton. Potential uses for these fibers include nearly every current application of textile materials. This work on new fibers should not only help to maintain the present level of consumption of 9 million bales of cotton but it also might increase it eventually by 1 or 2 million bales.

*Wearing apparel and household goods from cotton having improved crush resistance, drape, and appearance*

Wearing apparel and household goods comprise cotton's largest current markets, amounting in 1954 to about 3.3 and 2.7 million bales, respectively. Research to make cotton more attractive for these applications and to give it more consumer appeal has already paid big dividends. The most important advance in this field, which is based on the treatment of cotton with certain resins, stemmed from work done in many laboratories. The success of this development can be illustrated by pointing out that the quantity of cotton (estimated to be about 300,000 bales) treated annually with these resins now exceeds the production of the water-resistant manmade fibers. In addition, resin-treated cotton fabrics are now used successfully to make minimum-care or wash-and-wear garments that are competing with somewhat similar wash-and-wear garments manufactured from the manmade fibers.

Research now underway in the southern branch should lead to even further improvements in the competitive position of cotton in the fields of apparel and household goods. This research includes further study of the use of both new and conventional resins, treatments to improve certain fiber properties of cotton

and investigations to find which types of cotton fiber, yarn, and fabrics are best suited for making attractive textile products of high quality and consumer appeal. The improved use of resins might bring about several desirable changes, including enhanced crush resistance, soil resistance, dimensional stability, and abrasion resistance; water repellency or absorbency; improved hand, flame resistance; dyeing characteristics; and glazed and embossed surfaces. Only a small beginning has been made toward exploiting the attractive opportunities afforded by this general method.

Another area of research in the southern branch aimed at making cotton more attractive for apparel and household goods is concerned with chemical treatments that improve some of cotton's fiber properties such as elongation, toughness, and elasticity. We have already found that cotton can be treated with certain chemicals that will increase its toughness and improve its amenability to chemical treatments that cause favorable changes in elastic properties.

Because of the important influence of fabric construction (size of yarn, number of yarns per inch in the warp and filling, weave, etc.) on fabric properties, the southern branch is intensifying its efforts in this field. Through research of this type, it has already developed improved cotton fabrics for rainwear and summer flight suits for several agencies of the Defense Department. It is expected that future work on fabric construction will further enhance the value of cotton in apparel and household goods. Like the work on resin and chemical treatments described above, the research on fabric construction should improve cotton's position in markets involving several million bales.

*Stronger and more durable industrial fabrics*

The manmade fibers are giving cotton particularly severe competition in the field of industrial goods. Cotton duck, made from about 500,000 bales of cotton, is encountering increasing competition. Synthetic fibers are gaining in the manufacture of automobile tops, industrial hose, machinery belts, sails, and tarpaulins. To strengthen cotton's position in the field of industrial fabrics, the southern branch is conducting research aimed at improving tensile strength, tear strength, abrasion resistance, and other properties that govern serviceability.

Heavy industrial fabrics are being studied to develop yarn and fabric constructions having optimum properties and serviceability. With the commercialization of the loom attachment developed by the southern branch, it is now possible to produce cotton fabrics of much higher densities than those previously available. The dense fabrics made with the loom attachment resist the passage of wind and water, thus obviating the need of using waterproofing materials. It has been demonstrated that dense fabrics of this type can be used advantageously to protect baseball and other athletic fields. Such a cover, used experimentally during the past five seasons at the New Orleans baseball park, has shown no leakage of water and has given good service. Other possible uses for this type of fabric include hatch covers on boats; tarpaulins for trucks, outside storage and farm equipment; and temporary shelters. There is a potential market for 5.5 million bales of cotton for products requiring water-resistant properties and 2 million bales for products requiring wind-resistant properties, of which cotton holds only 31 percent and 50 percent, respectively.

Research on the application of resin and plastic emulsions or latices to cotton fabrics has indicated that this approach affords opportunities for improving properties important in many industrial end uses.

*New processing equipment to improve the quality and lower the cost of cotton textile products*

Some improvements have been made in textile equipment in recent years, but almost without exception the basic principles of cleaning, carding, spinning, and weaving cotton remain as they were when first originated more than 200 years ago.

The urgent need for improved cleaning equipment has been greatly intensified by the advent of synthetic fibers (which are clean and uniform in quality) and by the large increase in trashy cottons delivered to mills as a result of the transition to mechanized cotton production. The Southern Branch is developing an "integrated system" for cleaning cotton at the mills, which is expected to be twice as efficient as presently available equipment. With better cleaning equipment the cotton textile industry can use more advantageously trashy machine-harvested and rough hand-harvested cotton and can reduce the excessive manufacturing waste that is now experienced when mechanically harvested cotton is

processed into textiles. This should greatly aid efforts to mechanize the growing and harvesting of cotton as a means of significantly reducing the cost of cotton.

Current research to improve the uniformity of cotton card sliver and reduce the loss of spinnable fiber by a radical change in carding machinery has shown exceptional promise. If this work proves successful, and there is good reason to believe that it will, this achievement will result in a reduction of 25–50 percent in neps (tangled masses of fiber that detract from the value of cotton products) in the card web and a saving in card waste amounting to about $36 million annually, based on the current domestic consumption of 9 million bales.

Research on processing equipment will benefit all cotton textile products by improving quality and lowering costs. This should expand the utilization of cotton and increase the profits to the cotton farmer and processor.

*Research to enhance the value and utilization of cottonseed*

The growing of cotton fiber in the United States is accompanied by the annual production of 4 to 6 million tons of cottonseed, which has a farm value of more than $350 million and accounts for 12–19 percent of the farm value of the entire cotton crop. It is obvious that having adequate and profitable uses for cottonseed and its products will influence profoundly the economic position of cotton growers.

Cottonseed delivered to oil mills now contains more trash than formerly because of the increased use of mechanical and rough hand harvesting. Research at the Southern Branch to develop improved cleaning equipment (called the ARS differentiator) should have several distinctly beneficial effects. It should lead to a reduction in storage costs of $0.25 per ton or more than $1 million per year. Linters separated from the seed and worth about $60 million per year are in serious surplus. Use of the ARS differentiator should produce cleaner linters as well as seeds, thereby strengthening linters' position in competing with foam rubber, wood pulp, etc. It is expected that the differentiator will prove profitable also in obtaining seed of 100 percent viability for planting.

Fats and oils are in surplus and cottonseed oil has been purchased under Government support programs at times to the extent of more than 500 million pounds. Current research at the Southern Branch promises to benefit the utilization of cottonseed oil by effecting improvements in quality for conventional uses and by providing entirely new uses, such as coatings to prevent moisture loss in food products and as lubricants and plasticizers.

Cottonseed meal, used primarily as a cattle feed, is meeting steadily increasing competition from less expensive sources of nitrogen such as urea. Research has indicated that the feed value of cottonseed meal can be greatly enhanced, and processes are under investigation to develop improved meals for feeding chickens and hogs. This work is expected to result in expanded and more profitable markets for cottonseed meal. The cooperation of the National Cottonseed Products Association, which has had a fellowship program with USDA for almost 30 years, the State experiment stations, and members of the cottonseed industry has greatly aided this program.

It is anticipated that these and related research activities in the Southern Branch will help significantly both the cottonseed and cotton industries.

Mr. Chairman and members of the committee, I again wish to express my gratitude for this opportunity to discuss these subjects with you.

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STATEMENT OF DR. SAM R. HOOVER, ASSISTANT CHIEF, EASTERN UTILIZATION RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

Mr. Chairman and members of the committee, the surplus problem touches almost every phase of agriculture. In our research we are attacking the surplus problems of two of our most important agricultural commodities, dairy products and livestock.

The dairy industry represents a very large segment of American farming in terms of the dollar value of production. The farm value of milk production runs about $5 billion a year. Livestock production is even greater, totaling about $7 billion each year and accounting for about 30 percent of farm income.

So it is clear that help to these major agricultural industries will help many farm families.

The milk problem has been well publicized. Perhaps less well known is the problem of using up the excess byproducts from livestock production. Nevertheless, the livestock industry is keenly aware that in its operation, as in those of any other industry, profitable disposal of byproducts can mean the difference between black and red ink on the ledger.

### MILK AND DAIRY PRODUCTS

Milk production has increased markedly in the past few years, and it is still headed upward. This year it is expected to reach 127 billion pounds, the highest ever. If consumption were not increasing, this could spell trouble. However, last year consumption rose, and it continues to rise this year, so that this year's purchases for price support are expected to be about the same as last year's—5 billion pounds, milk equivalent.

Excellent progress has been made in moving butter, cheese, and dry milk solids, all of which has been bought under the support program, into retail outlets. In the early spring, the butter inventory was down to zero. In mid-May it was only 15 million pounds. Holdings of dry milk solids and cheese have been substantially reduced.

Nonetheless, even though the disposal program has been effective, it has been costly. In 1955 the cost to support prices of dairy products and incomes of dairy farmers was over $450 million.

One troublesome aspect of the problem is the case of butter. Butter represents only one-third of the solids present in the whole milk. The other two-thirds, mainly protein and sugar, are in the skim milk. When the cream is separated on the farm, the skim milk is commonly used as a feed, and this is a low-price outlet.

We are convinced that the most effective solution to the milk problem will be one which uses all the milk—in other words, a whole-milk product. The most attractive whole-milk product is a whole-milk powder meeting these three specifications:

1. It must reconstitute to milk of good flavor.
2. It must reconstitute easily.
3. It must have a long shelf life.

We expect that such a product would increase domestic consumption, especially in areas where fluid milk is not available. It would find increased use by the Armed Forces. It would find an export market. Such a product would relieve the butter surplus, and help solve the skim milk problem.

In recent years a nonfat dry milk with good flavor, which is easy to reconstitute, and having good shelf life has enjoyed a phenomenal expansion in sales for home use. Sales expanded twentyfold in 5 years.

It seems reasonable to expect a similar trend for a good whole-milk powder—when we produce one. We have made good progress toward such a powder. We have already met specifications 1 and 2. Our powder disperses quickly and easily, even in ice water, to give a milk with good body and excellent flavor—the same flavor as fresh whole milk.

We are not yet satisfied about specification 3; that is, shelf life. Fresh milk has a delicate flavor, and it doesn't take much off-flavor to make milk unpalatable. To solve the problem of shelf life we need to know which ones of the many components of milk are responsible for the development of off-flavors and for the loss of easy reconstitution. We need to know how processing affects these components. Getting the answers to these questions is taking us deep into study of the fundamental chemistry of milk, since that is the only way to find the answers. We can find them and we will find them.

So far we have made our whole-milk powder one batch at a time. But batch drying will not do for a commercial process. We are experimenting with a continuous high-vacuum belt dryer—the kind used to dry coffee and citrus juices. It looks promising, but we must carry our engineering studies much further to find the operating features which will turn out the powder in the required physical form.

### HIDES

Since livestock is raised primarily for meat, the supply of hides is fixed by the quantity of livestock slaughtered: that is, hides are a true byproduct. Within the past 5 years the farm value of hides has dropped under two sledge-hammer blows. One is the annual surplus—some 5½ million hides—resulting from the slaughter of great numbers of cattle for meat. The other is the shrinkage in the

market for leather because of the inroads of substitute materials. Because of these two factors hides now bring less than half the price they brought 5 years ago.

This loss in value totals some $200 million, which is reflected in the prices which would otherwise be received by livestock growers.

Consider shoe soles. Almost two-thirds of our shoes are presently soled with nonleather materials. In addition, nylon, cloth, and plastic materials pose a serious threat to the market for leather used in the uppers. And shoes have been the market for 85 percent of our leather.

To insure that leather retains its place in the sun, the development of new and broader uses is imperative. One promising approach is the chemical modification of hides to make leathers or other hide products with new properties, so as to obtain greater diversity of uses for hides. Another promising approach to the hide problem is the development of better, quicker, and cheaper methods for handling and tanning hides.

One of our goals in chemical modification is a fine, light leather which will be washable and hence easy to care for. Ordinary leather is ruined if it is washed in hot water. We have made progress toward a light leather that doesn't care how hot the water is. We treat a hide with a certain resin and make a beautiful white leather that keeps its color. In very hot water it shrinks, but on cooling it comes back to its former shape and size. This product may find use in gloves and other specialties.

Another goal of chemical modification is leather that wears better, is waterproof yet permeable, and which keeps its size and shape over a wide range of temperature and humidity.

We have made progress in this direction, too, by combining hide with a chemically modified starch. The product is cheap to make and uses nonstrategic materials.

There is also substantial room for improvement in the current practice of handling hides. For example, packers ship their hides to the tanner in a wet, salted condition. Only about one-fourth of the shipment will appear as leather; the rest is mainly water, salt, and hair, and someone is paying the freight charges on that.

We think it is possible to develop a simple, quick process to remove at the slaughterhouse the material that does not end up in leather and ship the hide dry. Such a process would mean better sorting and grading. The tanner could buy to better advantage and the producer could expect a greater return for a high-quality product. Shipping charges would be reduced.

But to accomplish these goals we need to obtain a lot more information than we have at present. A worthwhile, sustained attack on the chemical modification of hides must be based on knowledge of the chemistry of the hide proteins. This knowledge is the foundation on which we build the know-how. We are gaining the needed information now but we need to get it much, much faster.

We are investigating an enzyme process for removing hair from hide at the slaughterhouse. A good enzyme process would be a big step ahead, because it would solve a stream-pollution problem. We need to look into new ways of tanning; we have in mind ways that would assist the combination of the hide protein with a variety of chemicals in ways not attainable by the conventional tanning process.

### ANIMAL FATS

Animal fats are another byproduct of the meatpacking industry, whose production is at record levels because of high meat production, and whose once-substantial outlet has been slashed because of competition from synthetic and substitute products made from other raw materials.

Since World War II, synthetic detergents have been taking more and more of the market away from soap. Last year not much more than one-third of the household detergents we used were soaps; the rest were synthetics, most of them based on petroleum, a few on coconut oil. Of the 3 billion pounds of animal fats we produced last year, only 1.7 billion pounds were used domestically. The rest, fortunately, we were able to export. But the export market is notoriously unreliable and is not a satisfactory answer to the problem. What we need are diverse outlets for animal fats that will consume large quantities at substantial price levels.

With the encouragement and support of the Livestock Advisory Committee, we have conducted enough research, and achieved a sufficient degree of success, to

convince us that there is a tremendous potential market for animal fats in the huge and growing field of plastics, and that in the field of synthetic detergents we should be able to regain some of our losses to other materials.

*Plastics.*—This industry produces 1 billion pounds of plastics a year, and is the country's largest user of organic chemicals. It should be an excellent customer for materials made from animal fats. One of this industry's basic needs is for softeners to make flexible the hard, brittle material from which plastics are made. Softeners may be added to plastics to the extent of 35–40 percent. Animal fats are widely available and are excellent starting materials for the synthesis of softeners. One fat-based material, developed by our laboratories, not only softens the plastic, but makes it resistant to the effects of heat and light. Most vinyl plastics made today contain this softener to the extent of about 5 percent. Another development of our chemists is a completely new fat-based plastic whose softener is chemically bound to the base material. This plastic, now being manufactured in pilot-plant quantities, does not become hard and brittle with time and exposure to the weather.

Already 15 to 20 million pounds of animal fats per year go into plastics. This is an encouraging start, but our research should provide far wider uses for fats in this field. Our plan is to continue making fatty chemicals in the laboratory which should, when combined with existing bases, either lower the cost or improve the properties of the end material. When we are reasonably sure of the commercial feasibility of their manufacture, we make such materials into actual plastics and determine their physical properties. Most of our materials are modifiers for existing plastic bases, although some, like the one with the chemically bound softener, may be an entirely new type of plastic material. Among the possible applications for such plastics would be adhesives, protective coatings, flexible and rigid films, and molded products.

*Synthetic detergents.*—In the field of synthetic detergents, we see a good possibility of winning back at least some of the market that today is almost the sole property of the petroleum industry.

Synthetic detergents have wide use, even though soap is the best detergent in soft water. As washing agents, synthetic detergents are effective in very hard water and under other special conditions. Also, they have many and diverse industrial applications, such as in ore flotation and textile dyeing, where they make effective surface-active agents in water containing acids or metal salts.

There is nothing new about modifying tallow chemically to make a product that will do what soap won't do. Some of the first synthetic detergents were tallow based, and even today one widely sold commercial product contains a fat-based compound to the extent of about 25 percent of its acting ingredient. Nor is petroleum an inherently better starting material than tallow for detergent manufacture. In our laboratory we have made detergents from animal fats that are as good as, or better than, those made from petroleum.

One large meatpacker is now in pilot-plant production of two fat-based industrial detergents developed by our research. These can be produced quickly and economically, and we hope to see many applications found for them.

But to get wider household use we must improve our present fat-based detergents to make them more soluble, especially in hard water and at lower temperatures. They might be blended with a more soluble detergent, or the tallow might be further modified for better solubility. When we get better solubility, we can bring the price of fat-based detergents down by diluting them, as other detergents are, with certain sodium salts. Perhaps a combination soap and synthetic detergent can be developed that will not form soap curds in hard water.

These researches should find a solid place for animal fats both in the detergent field—in such products as packaged flakes, granules, powders, liquid detergents, and toilet bars—and in the wider industrial field as surface-active agents, such as emulsifiers.

And now let me summarze what I have said about these examples of our research on animal products.

In our attack on the milk problem, we have found out how to make a whole-milk powder which reconstitutes easily to give milk with good flavor. Much more research is needed to find out how to make the powder retain these good properties for a long time on the grocer's shelf, and how to make the powder with methods that industry can use. We believe such a powder will go a long way toward bringing milk consumption and production into better balance.

In our attack on the hide surplus, we have made some encouraging new products. But if we want to be certain that we will break through and win substan-

tial new areas for leather use within a reasonable time, we need to know a great deal more about the chemistry of hide material and about the tanning process. We believe that this new knowledge will lead to much wider use of leather, with resulting increased outlets for hides.

With respect to animal fats, we have already made some headway on using up the surplus. We have new chemicals for plastics, and new detergents, in pilot-plant production. We believe that accelerated research on the use of fats in plastics and in synthetic detergents will lead to greatly expanded markets for animal fats.

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STATEMENT OF M. J. COPLEY, CHIEF, WESTERN UTILIZATION RESEARCH BRANCH, AGRICULTURAL RESEARCH SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

Mr. Chairman and members of the committee, I appreciate the opportunity to describe to you briefly a few of the numerous active and promising research projects engaging the attention of our staff. The work I shall mention is directed toward solution of the diverse problems that hold back full utilization of such vital agricultural commodities as wool, apples, citrus fruits, potatoes, dry beans, and many other fruit and vegetable crops, the wheats of the Pacific Northwest, sugar beets, western-grown rice, legume forage crops like alfalfa and the clovers, and poultry and eggs. Significant new leads have recently been opened up in each of these fields.

Our research on wool is aimed at one of the most serious problems in American agriculture, namely, the progressive eclipse of our sheep-raising industry. Production of domestic wool has declined by more than 35 percent from the prewar average. The shift away from sheep raising has been accompanied by conversion of range land to cash crops, especially wheat; for example, in Montana alone about 4 million acres of grazing land has been thus released since 1939.

The decline in consumption of wool for garments is worldwide. It has been due in large part to the successful outcome of millions of dollars worth of research and development on the various new manmade fibers. These have been tailormade by industrial scientists to have various special qualities and advantages. There is no scientific reason why the wonderful natural fiber, wool, cannot have these qualities built into it if we make a comparable investment of research effort. Our research, although conducted on a relatively small scale, has already found important leads toward this objective.

These new discoveries offer the promise of wool fabrics that will require only a minimum of care, so resistant to shrinkage and other defects that garments may be ready to wear after simple home laundering and tumble drying. In addition, special treatments can make the fiber insect repellant and able to withstand the acid and alkaline conditions encountered in processing and use. These are some of the special qualities a fabric must possess to be competitive with the synthetics. Practical attainment of this goal will require a much broader program of research and pilot scale development that is possible within our present resources.

Even within the area of use still held by wool fiber, American-grown wools suffer under some disadvantages in competition with imported wools, to such an extent that nearly two-thirds of our usage of apparel wool is supplied by the imported fiber. We have recently discovered a new approach toward solution of one of the most important of these problems, namely, that the imported wools are whiter, on the average, than our domestic wool. The off colors in our wool, produced by a variety of conditions peculiar to American sheep raising, cannot be bleached out by conventional processes without seriously damaging the fiber. Our investigations give real hope that processes can be developed that will both bleach successfully and protect the white or pastel-colored fabric from yellowing during use.

Our wool-research program is responsive to urgent needs of the wool industry, as seen by its responsible leaders. Expansion of the work has been urged by the Department's Wood Research and Marketing Advisory Committee, the National Wool Growers Association, and spokesmen for the wool-using industries. Realization of the promise in our discoveries would quite surely raise the demand for American wool to or above the initial goal of 300 million pounds annually which was established in the National Wool Act of 1954. The increase above current production levels would require an additional 9 million acres of grazing land, much of it in States where sheep raising is almost the only alternative to wheat production.

Another field of work in which we are making notable progress is the development of new fruit and vegetable products in which excellent flavor, color, and texture are preserved by concentration or complete dehydration. Basically, the problem toward which this work is directed is the need for expanding markets for fruit and vegetable crops, by overcoming the limitations imposed by extreme perishability and high distribution costs.

The fact is that a substantial part of the price we pay at retail for fresh, canned, or frozen fruits and vegetables has gone into packaging, storing, and transporting plain water. In some cases as much as 20 tons of water is a deadhead passenger with every ton of actual food substance. Part or all of this water can be removed near the point of origin of the fruit or vegetable. To find acceptance, however, the new product must be quickly and easily prepared for use by restoration of the water; it must approximate the conventional product in color, flavor, and texture; and it must retain this high quality during storage and distribution. Attainment of these objectives is a difficult technical feat.

Scientists and engineers in our laboratories have accomplished a real technological breakthrough in this field. Dr. Hilbert has mentioned the commercial production of orange-juice powder and grapefruit-juice powder, made by a process of continuous vacuum drying which we developed. Tomato-juice powder made by a similar process will be made on a large scale this year. New fruit-juice concentrates are being developed from citrus and other tree fruits, berries, and subtropical fruits. Three new apple products show promise. One is a dry powder made from apple juice by a process of continuous vacuum evaporation; it carries the full apple flavor. Two others, for use in commercial pie baking, are made from apple slices by partial drying to reduce weight and volume and then preserving by canning or freezing. The "dehydrofrozen" apple slices have been in commercial production in New York State for 2 years. They are economical to package, transport, and store, and bakers find a great advantage in the high, uniform quality they can thus attain throughout the year.

The "dehydrocanned" product, designed for use where frozen storage is not available, is now being evaluated on a semicommercial scale by a packer in the State of Washington. The "dehydrofreezing" principle is also being used commercially to process pimientoes for use in cheese, where the product has positive advantages of low-moisture content and excellent color and flavor, in addition to the economy of packaging and transportation. Four plants have processed pimientos for this purpose, total volume last year being more than 3 million pounds of the fresh vegetable. Dehydrofrozen carrots, peas, and celery are being produced on a smaller scale for use in canned soups and other processed food products. In another recent development, completely dehydrated red sour cherries and peach slices show promise for new export markets because of the large saving in transportation costs, and may also be significant for overseas use by our Armed Forces. These new fields need much more intensive exploitation than we are able to give them.

Research on the utilization of potatoes has the purpose of expanding and stabilizing the market for potatoes by developing a broad range of processed potato products. The desperate need for such a stabilizing effect was demonstrated as recently as 1953, when a crop less than 10 percent larger than that of the previous year glutted the market and the total farm value of the crop was reduced by more than one-half. There is real hope in increased processing for preventing such gluts, developing export markets, and reversing the trend toward lower per capita consumption of potatoes.

Our research is opening up several promising lines of approach toward this goal. As Dr. Hilbert has told you, dehydrated mashed potatoes, in the form known as potato granules, have been on the market for several years, and our research has contributed to their success. An excellent new form, known as potato flakes, has recently been developed. A product like this, easy to store on the shelf and easy to prepare for eating, could bring mashed potatoes back to many a dinner table. Prepeeled potatoes, frozen french fries and other frozen potato products, and greatly improved dehydrated potatoes in several forms, along with potato chips and canned potato products, now account for almost 15 percent of our total food use of potatoes. The frozen french fries and prepeeled potatoes are experiencing especially rapid development. Our research has played an important role in expanding the use of potatoes in processed forms and we are confident that this development can go much further. In particular, processed potato products that will keep well even at a high temperature, that are easy to prepare and good to eat, can open up an entirely new export market in the tropical countries where potatoes do not grow well or

store satisfactorily. Half the population of the world never sees potatoes in any form. Even a minor development of the market would require more potatoes than the greatest surplus we have ever experienced.

One of our important research projects is devoted to the development and improvement of frozen foods. Food preservation by freezing has now grown to a point where large and important agricultural areas rely on the frozen-food processor as the major purchaser of their produce. That is the case, for example, in the citrus-fruit area of Florida and in the areas that specialize in raising turkeys or growing strawberries, peas, broccoli, and many other crops. Anything that affects the market for frozen foods affects these growers.

A problem that has caused concern both to these farmers and to the processing and distributing industry is the difficulty of consistently bringing to the consumer's table the highly desirable flavor, texture, and color of excellent fresh produce. Too often the package of frozen food brought home from the market does not have these attractive qualities, and customers are dissatisfied, perhaps lost. Our past research on frozen foods has contributed to notable progress toward uniform high quality in the products, and the public acceptance of frozen foods has continued to grow. Nevertheless, the industry is still keenly aware that quality defects do appear in its products at the time of purchase, and is convinced that its future growth hangs on finding a solution to this disturbing problem. The nature of that solution is not immediately apparent. In fact, a great deal of new basic information is needed to guide the rational and economical application of corrective measures.

For several years we have been engaged in a comprehensive investigation of this problem. More than 50,000 packages of frozen foods of many kinds have been studied exhaustively with respect to their behavior under the wide variety of conditions that may be encountered in commercial storage, transportation, and distribution. Much new knowledge of the kind necessary to meet this challenge has been developed, and practical means for preventing quality losses are being devised. This research is far from being finished. In fact, the frozen-food industry is growing and changing so rapidly that we should be devoting much more attention to this problem than our resources will now permit.

In our research on forage crops, work on improved processing of alfalfa and other legumes led us to make a new study of the composition of these crops. Out of this study have come discoveries which will have most important consequences when fully developed. Some of the newly recognized constituents turn out to have dramatic physiological effects on animals consuming the forage. Some are advantageous, others are harmful. Once these effects are understood and the substances responsible for them identified the way will be opened for development of greatly expanded acreage of these soil-building crops.

The most dramatic of the effects is the typical bloat produced in cattle or sheep when small doses of some of these compounds are administered. Bloat is one of the most troublesome problems of the livestock raiser. The value of animals that die from this cause is estimated to be at least $40 million per year, and large additional costs are incurred for treatment of sick animals and for management programs designed to minimize the trouble. While bloat has long been associated with the grazing of cattle or sheep on alfalfa or clover pastures, the exact cause has been in dispute. Out of our cooperative work with the Animal and Poultry Husbandry Research Branch of the Agricultural Research Service has come strong evidence that the substances known chemically as saponins are in large part responsible. A big job of research remains to be done to find out which of the several different saponins are responsible for the bloating effect and then devise practical ways to neutralize it or to grow legume forages containing little or no saponin. We also have evidence that elimination of saponin will overcome an inhibitory effect on the growth of young chicks when very much alfalfa meal is used in the feed. Following the recognition of this growth-depressing effect several years ago the amount of alfalfa used in poultry feeds was greatly reduced. The reduction in usage actually went beyond what was warranted by the known facts. The alfalfa dehydration industry, which is heavily dependent on this market, has been seriously affected.

We are also finding unsuspected growth-promoting substances in these legume crops, and are actively exploring their identities and effects. Our aim is to find out how to build up and preserve the numerous beneficial substances and eliminate the deleterious ones.

Finally, I shall describe briefly a few of our rapidly advancing lines of research on utilization of poultry and eggs. These farm products find a retail market amounting to over $5 billion per year. Poultry and egg production is

also a potent factor in the utilization of grain; about one-third of all the grain fed to animals is used by the poultry industry. Increase in demand for poultry and eggs would have a real impact on grain surpluses.

We are making progress in developing or improving products with a built-in convenience of use, in assuring the maintenance of high quality during processing and distribution, and in lowering costs by increasing the efficiency of processing methods. Advances along these lines can very promptly stimulate increased demand for poultry and eggs.

In the field of egg products, research conducted some years ago changed the whole picture of egg dehydration for the better, and a solidly based industry has been established. However, a problem that still limits the usefulness of whole egg and egg yolk powders is that during drying they lose some of their ability to make fluffy cakes and creamy mayonnaise or other salad dressings. Correction of this defect would permit the introduction of new convenience foods such as a complete sponge cake mix, as well as a more economical ingredient in other baked products and in salad dressings. Research advances of the past few years have largely solved a similar problem in the drying of egg white. A large new market has resulted from the popularity of angel food cake mixes.

Several possibilities have been found for correcting the deficiencies of dried whole egg and yolk. These include addition of certain edible protective agents before spray drying, the use of edible emulsifiers, and the development of alternative drying methods.

In the poultry meat industry a problem of toughness in some products is causing concern. While "tenderizing" has always been recognized as an essential step in the processing of beef, only recently has serious toughness in frozen young turkeys and chickens been apparent. The fact that the problem is of recent origin implicates recent changes in processing methods and kitchen practices. Among these changes are the use of higher scalding temperatures, mechanical picking of feathers, reduction in time of holding before freezing, more rapid freezing to insure attractive appearance, and recommendations for cooking the frozen bird without a preliminary thawing and holding period.

Research on this problem has provided important advances in knowledge of the effects of these several factors and has suggested ways to secure improvement. Much remains to be done, however, to accomplish full tenderizing while still retaining the efficiency and sanitary desirability of current operating practices.

Researches on convenient precooked frozen poultry products are developing methods for retaining the desirable freshly cooked quality in these products by solving troublesome flavor and texture problems. If these difficulties can be overcome, the convenience factor is certain to multiply consumption of these products manyfold.

Problems of flavor instability, such as loss of fresh poultry flavor and development of staleness, rancidity, or fishiness, are more serious in cooked than in raw frozen poultry products, and become particularly serious when storage periods are extended and the foods are subjected to relatively high storage temperatures in distribution. We are studying the conditions under which frozen products such as turkey dinners, turkey pies, and fried chicken develop undesirable flavors. The causes of these flavors and methods of preventing them are being investigated. Promising progress is being made toward the prevention of rancidity.

Texture problems are most apparent in those precooked frozen poultry products that are thickened with starch, flour, or egg. Such products include those containing sauces or gravies, like creamed chicken, a la king, and chicken pie, and custard- and pudding-type desserts. The major change that occurs in these foods during prolonged frozen storage is liquid separation and a curdled appearance after thawing. This change can be retarded in products stored at 0° F. by use of a unique thickening agent, waxy rice flour. We are now studying the prevention of this kind of change even at the higher temperatures that occur in commercial distribution of frozen foods. Additives such as pectin and gelatin in combination with waxy rice flour show considerable promise of retarding changes under these more severe storage conditions.

Mr. Chairman and members of the committee, I have tried to show you a few examples of the kind of research progress that can mean headline success stories if the work is pushed ahead vigorously. Basic discoveries about the chemical modification of wool fiber, along with improvements in processing methods, can lead to rejuvenation of a great industry. The new fruit and vege-

table concentrates offer advantages in stability and economy of distribution that can open entirely new markets. New processed forms of potatoes may arrest the decline in consumption and enter export markets never before tapped. Improvements in the processing and handling of frozen foods will remove a barrier to further tremendous expansion of this young industry. Alfalfa and clover forage crops, with their great soil-building value, will come into their own when we find out more about their harmful and beneficial constituents and learn how to exploit that knowledge. New forms of dried eggs and greatly improved frozen poultry products will stimulate a consumer demand that can very quickly create a market for millions of bushels more of the feed grains. We confidently believe these great benefits to American agriculture and the American people will be realized if we go after them with resources that measure up to the need and the opportunity.

Mr. ABERNETHY. We thank you very much, gentlemen.

Dr. CLARKSON. We thank you.

Mr. ABERNETHY. Are there any other witnesses who wish to testify?

(No response.)

The committee will stand in recess subject to call.

(Whereupon, at 11:40 the committee recessed subject to call.)

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